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Automatic Control of Concentration in the Mercerizing Process

Control in the Acid Bath—Apparatus—Operating Results—Control by Gravity or by Conductivity—Discussion

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THE mercerizing industry has proven to be one of the most progressive of those in which chemistry plays a fundamental role. A recent advancement in the art of mercerizing consists in the adoption of automatic control of acidity by conductivity methods. The control has proven a labor and material-saving device, and its use has resulted in a more uniform and a better finished product.

In the usual mercerizing process, the cotton yarn is drawn over steel rollers through a series of ten to fifteen baths. The first bath is of concentrated caustic, where the mercerizing takes place. Most of this caustic is rinsed out while the yarn is passing through the next group of baths. The yarn is then drawn through a bath which is maintained at an acid concentration varying from 2½ to 3½ per cent sulphuric acid, according whether the yarn is light or heavy. The yarn is again rinsed in two or more baths before passsing through a bath which is slightly alkaline. It is again thoroughly washed before it is finally ready for drying.

From the standpoint of automatic control, a most important bath is that maintained in the neighborhood of 3 per cent sulphuric acid. The other baths maintain their concentration comparatively well during a day's run, but the acid bath requires the frequent addition of acid to make up for that used in the neutralization of the caustic, which is carried over in the yarn from the mercerizing bath. If the acid in this bath is too strong, it may be carried over in the yarn until the slightly alkaline bath, mentioned above, may be neutralized. On the other hand, if the acid concentration is too weak, the residual caustic in the yarn is not neutralized and the result is a product subject to rapid deterioration. This acid bath, consequently, is one of the prime factors in determining whether the reaction of the finished cotton will be on the acid or the alkaline side of the neutral point. A close control of this reaction determines, to a large extent, the uniformity of the color obtained, when the cotton is dyed. It has been demonstrated several times that this uniformity has been increased after the introduction of automatic control in this bath.

Apparatus

After automatic control has been in successful operation for about three months in one of the recent mercerizing installations, permission was obtained to make a series of tests, during actual plant operation, in order to determine just how close to the proper value the acidity of the bath was being maintained. Several photographs were taken of this installation in order to give a complete description of the method.

In Fig. 1 is shown the acid bath, which is controlled in the neighborhood of 3 per cent sulphuric acid. The conductivity cell is shown at *A*, while the acid supply line is shown at *B*. The cell is made of glass with band type electrodes, but is well protected by a lead case.

The supply of concentrated acid (about 75 per cent sulphuric) is kept in the tank which is shown at *C* in Fig. 2. At *D* is shown the automatic solenoid valve. The acid supply line is indicated at *F*, while the old, hand-operated, acid valve is shown at *E*. The recording controller is shown at *G*. The solenoid valve, made of hard lead, is shown in closer detail in Fig. 3.

In the apparatus shown at *G* in Fig. 2, a hand temperature compensator is located on the recorder panel. This is adjusted at intervals as the temperature of the bath changes. Even this occasional manipulation may

now be eliminated by the use of a closed auxiliary cell containing a solution of 3 per cent acid, which automatically compensates for temperature changes of the bath.

The recorder is of the familiar self-balancing Wheat-

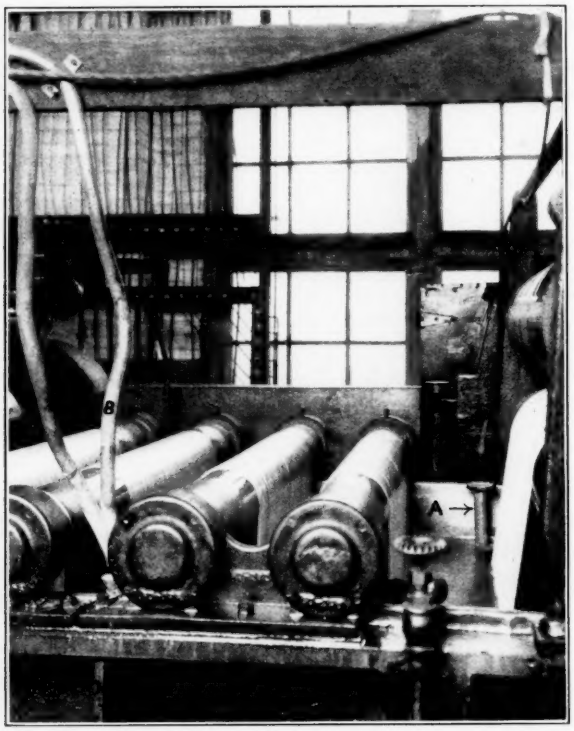

FIG. 1—*Dilute Acid Bath and Conductivity Cell*

stone bridge type. The conductivity cell is placed in one arm of the bridge. The resistence offered to the passage of the alternating current, between the two electrodes, for a given disposition of the electrodes and at a given temperature, is related directly to the acid concentration of the bath. This instrument, therefore, not only automatically controls the concentration at its proper value, but also shows by its continuous record what the actual concentration is at all times.

The control is obtained by the use of the usual alarm contacts which are actuated by the control disc. The latter may be adjusted to close the alarm contacts at any desired value of acid concentration. The alarm contacts close the circuit of a relay, which in turn closes a circuit which operates the solenoid valve. The action of the control, therefore, is to open the solenoid valve when the concentration falls below a predetermined value. After the acid concentration has built up to the desired point the valve is again closed.

OPERATING RESULTS

A record obtained during a factory operation of six hours is shown in Fig. 4. The range of the recorder chart is from 2 to 4 per cent sulphuric acid. The vertical line drawn through the record shows the control point (set at 2.88 per cent) or, in other words, the point at which the valve operates. When the record is at the left of this line the valve is open, and to the right it is closed.

During the six-hour run, represented by this chart, frequent analyses were made to determine just how closely the concentration was being maintained. A total of twenty-two samples was taken during the run and the values obtained by analysis are given in Table I:

TABLE I

Sample No.	Time in Hours	Sp. Gr.	Per Cent H_2SO_4
1.....	1.00	1.024	2.87
2.....	1.45	1.024	2.71
3.....	1.87	1.024	2.81
4.....	2.00	1.024	2.78
5.....	2.23	1.024	2.96
6.....	2.37	1.024	2.71
7.....	2.67	1.0265	2.79
8.....	2.82	1.027	2.81
9.....	3.08	1.028	2.75
10.....	3.77	1.028	2.81
11.....	4.00	1.028	2.80
12.....	4.38	1.030	2.80
13.....	4.40	1.031	2.75
14.....	4.63	1.0325	2.71
15.....	4.80	1.035	2.94
16.....	5.38	1.040	3.00
17.....	5.55	1.041	2.81
18.....	6.17	1.045	2.99
19.....	6.33	1.045	3.04
20.....	6.45	1.047	2.90
21.....	6.63	1.046	2.87
22.....	7.08	1.048	2.96
Average			2.89%
Average deviation from mean.....			0.096
Maximum deviation from mean.....			0.18

As will be noted, from this table, the highest and lowest values were 3.04 and 2.71 per cent, respectively, while the average deviation from the mean was only 0.09 per cent. The mean value was 2.89 per cent, which agreed almost exactly with the control setting of 2.88 per cent. This control is evidently well within the required accuracy.

Prior to the introduction of automatic control, the concentration of the bath was adjusted according to infrequent readings of a Twaddell hydrometer or, more frequently, by the time-honored method of relying on the tasting ability of one of the operators. No data are at hand to ascertain just how close a control this method is capable. However, in Fig. 5 are plotted the results obtained during a short period of hand control by rather frequent chemical analysis. The data in Table I are plotted, for comparison, on the same chart. The desired

concentration, during hand control, was 2.5 per cent acid, while the average value actually obtained was 1.8 per cent. At no time during this run was the desired concentration reached. The average deviation from the mean was more than double that obtained with automatic control. It is evident, consequently, that automatic control is greatly superior to hand control, even though frequent chemical analyses are made.

Fig. 6 shows a record from the first installation of automatic conductivity control upon this type of an acid bath. In this plant the overflow from several baths unites in a sump, which is supplied with efficient agitation. The control operates in this sump to maintain an acid concentration of 3 + 0.15 per cent sulphuric acid. From the sump the solution is pumped up and redistributed to the various baths. Before automatic control was installed at this plant a chemist was employed to make a continuous series of titrations in order to maintain the proper control in the several baths. The automatic control has not only saved this labor, but it has also maintained the baths within a very much closer range of acidity. The control in this plant has now been operating successfully for about four years.

Laboratory experiments were undertaken to determine how close a control could be maintained by keeping the specific gravity of the bath constant. To determine this point a solution of 3 per cent sulphuric acid was made up. Its gravity was measured. Sodium sulphate was then added in increasing quantity and sufficient water added to maintain the solution at its original gravity. A sample of the solution was analyzed each time the gravity was brought back to its original value. Similar experiments were undertaken with conductivity measurements as a basis. In this case, upon the addition of sodium sulphate

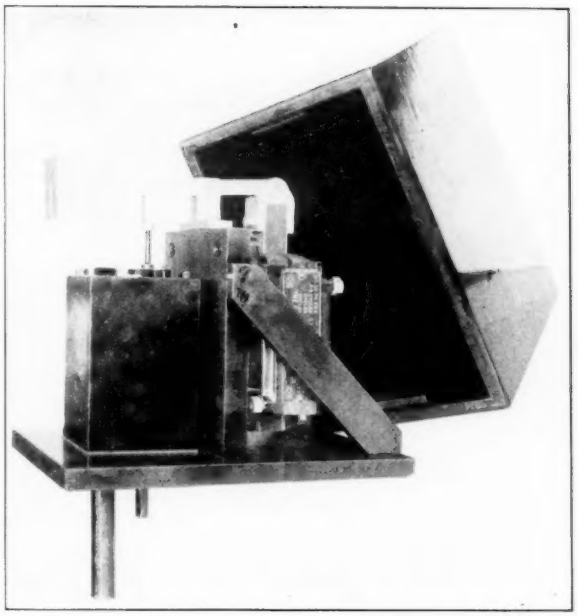

FIG. 3—*Solenoid Valve*

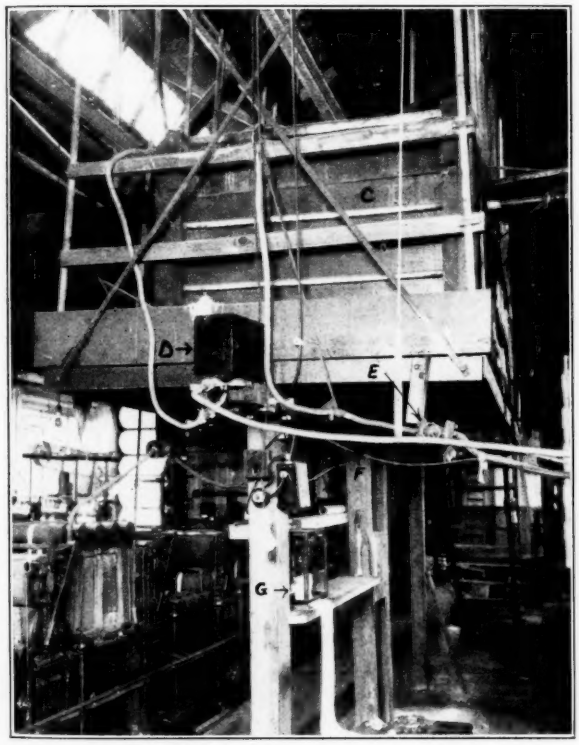

FIG. 2—*Concentrated Acid Tank, Solenoid Valve and Recorder-Controller*

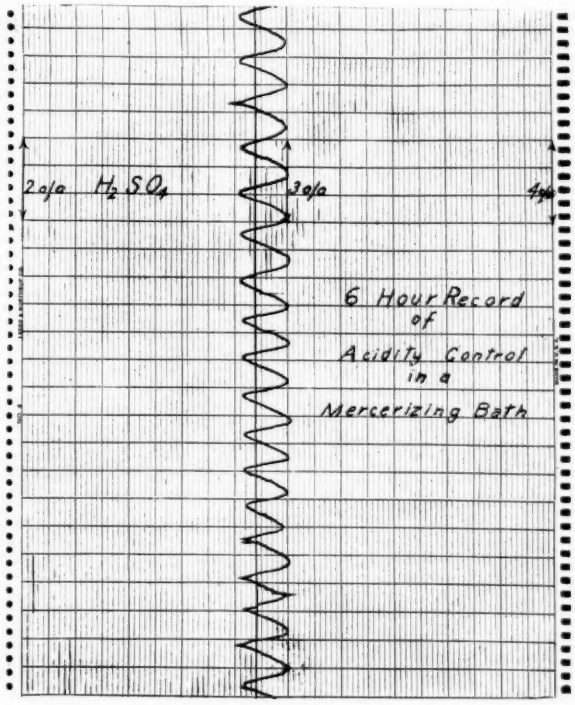

FIG. 4—*Acidity Control Record*

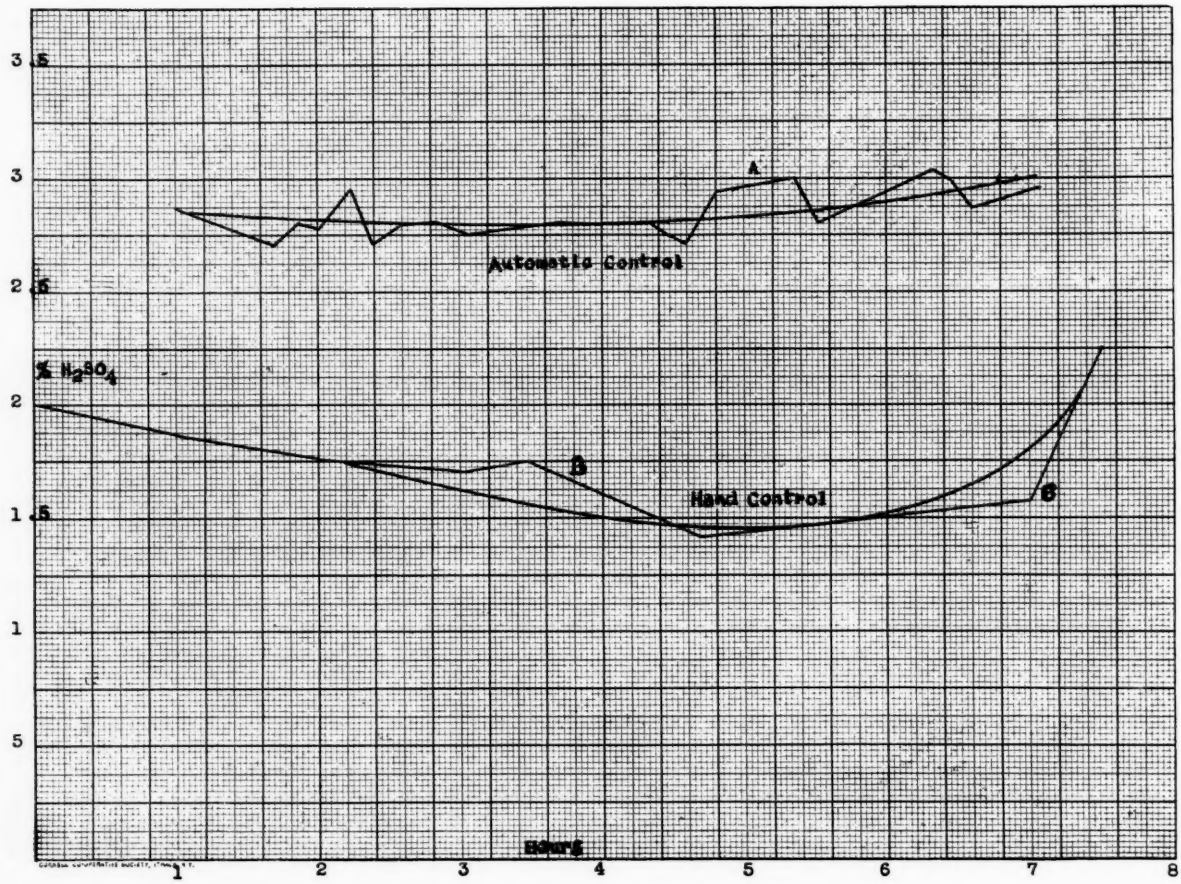

FIG. 5—*Comparative Accuracy of Hand and Automatic Control*

the original conductivity of the solution is depressed and can be restored only by adding more acid.

The results of these experiments are shown in Fig. 7. It is evident that, in control by gravity, the concentration of acid is diminished with considerable rapidity, until at a concentration of about 21 grams per liter of sodium sulphate, the acid concentration becomes zero. On the other hand, with conductivity control, the concentration of acid gradually builds up to about 3.2 per cent, while the sodium sulphate is building up to a concentration of 16 grams per liter.

It may well be noted that an increase in titratable acidity is necessary to maintain the H-ion concentration of such a mixture constant, and that it is this factor, rather than the total acidity, which determines the neutralizing ability of the bath. The acidity of such a bath is too high to control successfully by H-ion methods, but it is evident, from the above, that the desired result is closely approximated by conductivity measurements.

In the control by Twaddell readings, it is usually attempted to gradually increase the readings, during the course of a run, rather than to keep the reading constant. It is evident, however, that the correct reading for the Twaddell must depend upon how much caustic has been carried over in the cotton, and this can only be determined by a chemical analysis. It may also be mentioned that most plants that control their acidity by gravity readings make no temperature correction. But a change in temperature of 10 deg. Fahr. causes an error of nearly 0.3 per cent in acid concentration.

DISCUSSION

The chemical process industries in this country have been rather conservative in their attitude toward the adoption of what are considered "scientific" or "theoretical" methods. It appears probable that this tendency largely accounts for the prevalence within them of so many time-worn, rule of thumb methods of control. Many of these methods are not only wasteful of chemicals, but are also injurious to the health of the employees. One illustration of this point is the method of "tasting" to determine acid concentrations.

Recently it has become apparent that this conservatism, in the chemical industries, is being replaced by a more open-minded attitude, particularly toward the subject of automatic control. There is no doubt but that the automatic control of temperature has already won a dem-

onstrated field of usefulness in many chemical manufacturing processes. There are many other processes where automatic control by conductivity or H-ion methods will undoubtedly prove even more advantageous. In the near future an industrial chemist will require, not only a knowledge of routine tests, but also a working knowledge of the methods of electrochemical control. The chemical industry is undoubtedly losing millions of dollars annually on account of the present lack of familiarity with and failure to adopt these control methods.

From the data and discussion given in the preceding paragraphs it is evident that dilute acid control by conductivity methods is both feasible and practical. It results, in the mercerizing industry, in a saving of chemicals, in a saving of labor, and in the production of a higher grade of finished materials.

1. The apparatus and methods for automatic control of acidity in the mercerizing industry have been described.

2. In comparison with hand control, automatic control has been shown to be superior in accuracy.

3. Automatic control prevents waste, saves labor and removes a source of injury to the health of employees.

4. Automatic control produces a cotton less subject to deterioration and more uniform in its action towards dyestuffs.

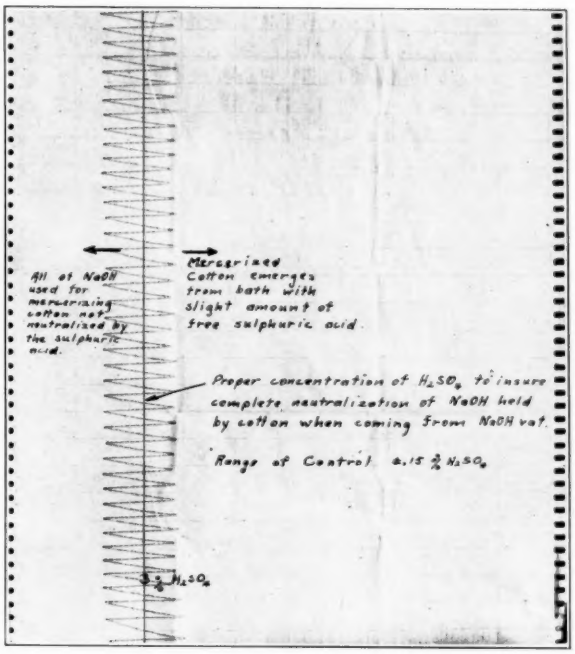
All of NaOH used for mercerizing cotton not neutralized by the sulphuric acid.
Mercerized Cotton emerges from bath with slight amount of free sulphuric acid.
Proper concentration of H_2SO_4 to insure complete neutralization of NaOH held by cotton when coming from NaOH vat.
Range of Control .15 % H_2SO_4
.3 % H_2SO_4

FIG. 6—*Acidity Control in First Automatic Installation*

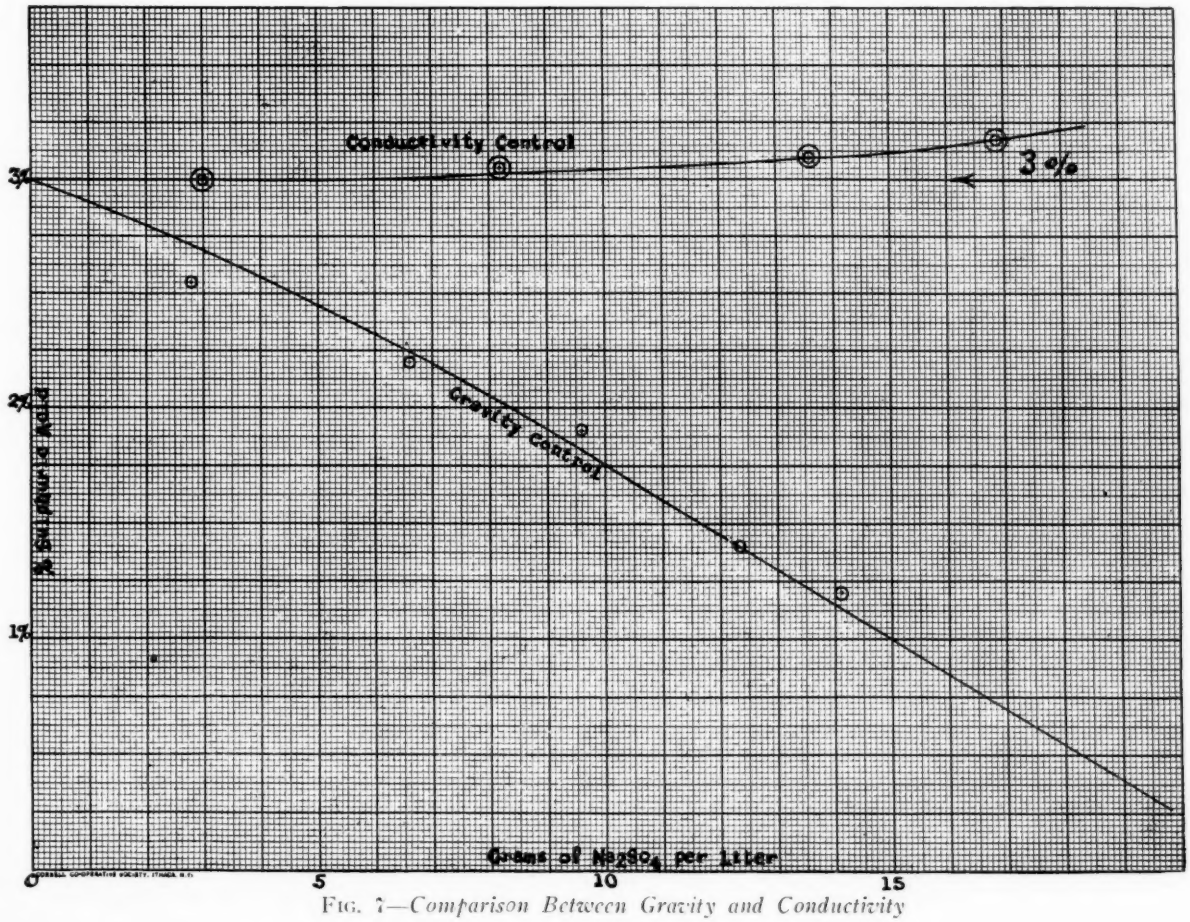

FIG. 7—*Comparison Between Gravity and Conductivity*

Chemical Treatment of Trade Waste

Part I

Dye Wastes in General

Classification—Coagulation—Bleaching, Decolorization and Distillation—Standards and Methods of Testing

By FOSTER D. SNELL, A.M., Ph.D.
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DRECHSLER[1] has discussed coagulation treatment and has stated the following principles: (1) The liquor should remain in contact with sediment only a short time; (2) slime should be protected from air; (3) a large collection of slime should be avoided. These points were made with particular reference to sulphur dyes. Schultz[2] recommends treatment with kieserite ($MgSO_4$, H_2O) and lime, followed by sedimentation and filter-pressing of the sludge. The filtrate is then neutralized with sulphuric acid, aereated, allowed to stand thirty-six hours and the sludge filter-pressed. The cost sounds prohibitive. The degree of purification obtained should be high.

Filtration through coke, lignite and other filters, with or without added absorbents, has received considerable attention. Battige[3] has discussed filtration through lignite slack, recommending it in preference to coagulation, and claims a clear, colorless effluent, on which analytical data are given. Polz[4] and Stein[5] discuss removal of color with colloidal clay and lime. Strell[6] recommends ground peat, followed by coagulation if necessary. Ullmann[7] recommends aereation, alkali treatment and addition of a fibrous material, such as straw, shavings or leather scrap, to remove the last of the color.

The principal investigation of dye wastes published in this country is that by Casselman.[8] Wastes from dye and intermediate manufacture were systematically studied, and coagulation with copperas and lime recommended for all except one waste which did not respond to coagulation. He summarizes treatments cheaper than evaporation as follows: by aereation, chlorination, coagulation, boiling or partial evaporation, re-use, ether extraction, dilution, bacterial action, or by use of activated carbon, strong reducing or oxidizing agents, or alkali. All of these methods might have special applications where they would be economical.

Classification

Problems relating to purification of dye works waste may be sharply divided into those in which all of the waste must be treated and those in which a limited amount of waste may be discharged through community sewers and only the balance need be purified. The latter case is much simpler and cheaper, because the worst of the discharge may be "scalped" and the clearest part treated by chemical means.

For the removal of color and impurities from a waste there are four important practical methods, which, in order of their importance, are coagulation, oxidation or reduction, decolorization by carbon, and evaporation. A waste would be treated by the latter two methods only under the most extreme conditions.

In any case, laboratory experiment must show the efficiency of the method of treatment on each effluent. If a plant runs into its sewer the waste waters and other discharges from twenty different operations, it will usually be found that the majority of these are easily treated, but that one or two offer particular difficulty. If a limited outlet is available and the amounts of the latter are not too great, they are best discharged directly to the sewer and the balance treated chemically. In a recent case of a dye plant, by direct discharge of 4 per cent of their effluent the cost of chemical treatment was reduced to about 20 per cent of that necessary for treatment of the combined effluent. Soap liquors are particularly difficult to purify and nearly always leave a yellow effluent. Unless the quantity is small, they are most economically treated separately, sometimes with recovery of red oil.

Coagulation

Treatment by coagulation consists of treatment with copperas, alum or a similar salt, and addition of the proper amount of lime. An acid effluent must be made alkaline with lime, whereas an alkaline effluent may need only the addition of the metallic salt. If results can be obtained with it, copperas is the cheapest coagulant available in the average case. In the settling basins it is partially oxidized to the ferric form, so that the precipitant actually used is a mixture of ferrous and ferric hydroxides. The addition of a small excess of lime causes more rapid settling. Considering the increased cost of larger settling basins, even

if cheap land is available, the treatment must usually be such as to cause practically complete settling of the precipitate within twelve hours.

Control of the alkalinity has been greatly facilitated by recent development[9] of automatic apparatus which will control the rate of feed of either dry lime or a lime slurry so as to obtain constant alkalinity. By laboratory determination of the proper alkalinity the apparatus can be set to operate at maximum efficiency with the minimum amount of lime.

With a properly constructed settling basin, the liquid may be run through in about three hours, the basin being so constructed that in that time the flocculent precipitate has fallen to a slower moving level and ultimately to a practically stagnant region near the bottom of the basin. This result may be obtained either with a simple settling basin or by the use of special patented apparatus. Economy of space at the expense of greater cost of installation is obtained with the latter. The advantages of upward flow of the clarified liquid may be obtained with either.

Bleaching, Decolorization and Distillation

Treatment with bleaching agents may mean the use of chlorine or bleaching powder. So far this is mainly of theoretical interest. In many cases the main portion of color could be removed with bleaching powder. A dye plant often has waste bleach liquor, so that this treatment may not represent any additional cost or only a small one. The discharge of strongly oxidizing or reducing solutions into streams is highly objectionable, so that any excess of reducing oxidizing agent must be removed. The use of chlorine for this purpose has recently been discussed[10] by a representative of a large equipment manufacturer.

Decolorizing carbons have not been used to any great extent for this purpose. In many cases they will not operate satisfactorily, and when they do they necessitate the use of new equipment concerning which there is no great amount of information. The use of decolorizing carbon requires an arrangement for reactivation after use in order to be economical. The machinery for this process of treatment is available. It is unfortunate that most of the work on this subject has not been published.

Evaporation is usually only a last resort. In a region where pure water is difficult to obtain, it is conceivable that the use of the distilled water would make it economical, balancing its cost against the combined cost of other methods of purification of waste and softening of water for the industrial plant. In the recovery of potash from wool washings, evaporation becomes a necessary part of the by-product recovery.

The standards required for the treated waste to be acceptable for discharge are variable according to the nature of the waste and of the stream into which it is to be discharged. Barbour[11] has proposed a standard of not over 300 p.p.m. of total solids, 200 p.p.m. fat, no abnormal acidity or alkalinity, and removal of pronounced antiseptic properties. In many cases this standard of total solids works an undue hardship. The others are general practice.

In general, determination of total solids and loss on ignition gives a rough estimate of the degree of contamination. Of these, the loss on ignition is important, whereas usually the total solid content is of little importance. A quicker and simpler method for routine testing of the degree of contamination of a trade waste is oxygen consumed by the permanganate method. The biochemical oxygen demand is more indicative of the real contamination by organic matter, but is so difficult of manipulation and uncertain as to results as to fail to justify the expenditure of time.

If toxic materials, such as phenols, are present, neither of these methods will show the true menace of the waste. Danger from this source is best met by a complete survey of the plant and consideration of possible danger from the various materials in use. The treated waste may then be tested to judge the degree of purification with regard to such materials. A quick and satisfactory test for the presence of materials toxic to fish life may be made by keeping fish in the treated effluent, either with or without dilution. An extensive series of tests of this type on brewery waste have been described.[12]

While there is nothing in the color of a waste necessarily harmful, it is usually the principal point considered by non-technical people. A suitable method of measuring colors before and after treatment is by use of a Lovibond tintometer, using a cell thickness of 50.8 mm. (2 inches). If the color is too deep for reading in this thickness, an approximate value may be obtained by dilution with distilled water in the ratio of 1:9 and multiplication of the result so obtained by ten. The reading in a thinner cell may also be multiplied by a suitable factor. The Lovibond scale has been shown[13] to be accurate for values less than 50. Final values used for comparison of treated effluents fall within this range. In general, if the total color of an effluent is less than five units by this method of determination, it is satisfactory. After dilution in the stream the color becomes negligible.

In consideration of the degree of purification necessary, an English decision is of importance.[14] The actual expression is: "The claim that an effluent shall in composition be identical with the river water without reference to the question of damage is not one which should be entertained." In other words, the purity of the water may be lessened by commercial use provided no actual damage can be shown. Similar opinion has become the established practice in several

States. The conditions in Pennsylvania were recently discussed.[15]

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[3] Gesundh. Ing. 36, 206 (1913).
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[12] Robert C. Littlefield, Chem. and Ind. 44, 864 (1925).
[13] B. W. Parsons and R. E. Wilson, Ind. Eng. Chem. 14, 269 (1922).
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Paper Sizing Studied by Bureau of Standards

THE effects of surface sizing on the strength of paper was the subject of a recent interesting investigation by the United States Bureau of Standards. The results of the tests are embodied in the following report from the bureau's technical news bulletin:

"Fine papers are ordinarily sized to obtain a smooth, non-absorbent surface by immersion in a bath of animal glue. Such surface sizing also effects marked changes in the strength and resistance to wear of paper so treated.

"During investigational work on the manufacture of rag papers in the bureau's experimental paper mill, papers were produced weighing about 22.5 pounds, 17 by 22 inches, 500, that had a minimum folding endurance of approximately 2,500 double folds for a 100 per cent cotton fiber paper and up to 5,000 double folds for a paper of 75:25 linen-cotton fiber ratio, these tests being made on the waterleaf (unsized) papers. Ordinary tub sizing with medium grades of animal glue added generally from 1,000 to 1,500 more double folds to the tests of the waterleaf papers. These folding endurance tests were made at 65 per cent relative humidity. The results, in general, of the study of the effect of surface sizing made in the course of this work indicate that with any given paper: (1) the bursting strength increases with increased retention of the glue; (2) the folding endurance increases with increasing glue content to a certain point, and then decreases; (3) the resistance to water and to wet rubbing of glue-sized papers may be markedly increased by treatment with glue hardening or tanning materials, such as formaldehyde, but such treatment requires careful control, lest the folding endurance be adversely affected; (4) the folding endurance of both unsized papers and surface-sized papers, whether or not hardening agents have been used, may be increased by the addition of certain softening agents or lubricants, such as glycerine or non-drying oils; and (5) a limited number of tests check outside opinions that the effect of glycerine treatments, as ordinarily applied, on the folding endurance of paper is comparatively short-lived. A number of variables in the paper-making processes affect the degree of sizing imparted by immersion of the paper in animal glue, and to these must be added the influence of variations in the size itself. Printing tests by the wet-intaglio process on experimental rag papers lead to the tentative conclusion that tub sizing with glue prepared from hide cuttings by paper manufacturers does not produce papers that differ noticeably from those tub-sized with commercial glues. Tests made by the standard methods of the National Association of Glue Manufacturers on several samples of size made from hide cuttings in paper mills show that their jell strength and viscosity are similar to those of medium grade commercial glues. It would appear that the use of uniform commercial glues of known characteristics should aid in maintaining control of some of the variables of the tub-sizing process. The successful use of the standard glue testing methods by the Government Printing Office in their specifications for glues used in printing and binding processes suggests the possibility of drawing specifications for commercial tub-sizing glues to meet the local requirements of individual mills.

"This preliminary study shows that in the application of tub-sizing and chemical treatment processes to different types of papers, there are required a broad study and exact knowledge of all the factors involved in order to control the improvement of qualities of papers along desired lines. It is planned to study further in the bureau's paper mill some of the factors influencing glue surface sizing."

ANNUAL SURVEY OF CHEMISTRY ISSUED

A "Survey of American Chemistry," covering the period July 1, 1925, to July 1, 1926, has just been published by the Division of Chemistry and Chemical Technology of the National Research Council. Prominent authorities in thirty-two fields of fundamental chemical research co-operated in compiling data for the survey.

Advance orders received at the office of the National Research Council before January 31 for this volume, the first in a series, will be filled at 20 per cent from the list price. After January 31 orders can be placed only with the publishers, the Chemical Catalog Company, Inc., New York.

L. R. Gilbert, a textile graduate in the class of 1907 of North Carolina State College Textile School, and for several years superintendent of the Caraleigh Mills, Raleigh, has become treasurer and general manager of the Audrey Spinning Mills, Weldon, N. C. Mr. Gilbert is also the vice-president of the Southern Textile Association.

Proceedings of the American Association of Textile Chemists and Colorists

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DECEMBER MEETING OF THE NEW YORK SECTION

The regular December meeting of the New York Section of the American Association of Textile Chemists and Colorists convened Friday evening, December 10, at the Machinery Club, New York City, Herbert Grandage, chairman of the Section, presiding.

When the routine business of the Section had been transacted, the Chairman introduced the speaker of the evening.

Chairman Grandage—Our program for to-night is somewhat irregular in that the second half of it is, supposedly, going to cover a report of the Annual Meeting in the South. We will put that off until after we have heard the paper of the evening by Mr. Stott. Mr. Stott has chosen for his topic, "A Short Discussion of the Manufacture of Some of the Better Known Dyestuffs."

Mr. Stott! (Applause.)

A Short Discussion of the Manufacture of Some of the Better Known Dyestuffs

By P. H. STOTT
Newport Chemical Works, Inc.

I don't know just how to approach the subject that I selected when I was asked to speak here, more or less at the last minute. It occurred to me that as long as I was acting somewhat in the capacity of a pinch-hitter, it might be of interest to some of the men who are selling dyestuffs and using them to have a slight explanation of some of the manufacturing processes, based on the theory of the chemistry of benzol and other compounds of that type. I shall try not to take up too much of your time. It is a subject, of course, which takes almost a lifetime's study to understand and appreciate in all of its details.

I think, perhaps, I ought to explain at this point that by actual choice of profession I have been a manufacturing chemist, and it is only within the last two or three years that I have left the manufacturing side and gone over to the application side. Which is the worse of the two, I haven't yet decided. However, the chemistry of dyestuffs is a very fascinating study, and I am reminded at this point of a gentlemen whom I once met—I think it was in Milwaukee when the Newport Company had an exhibition there of some of their products. They were featuring the slogan, "Coal to Dyestuff." This gentleman came up to me (I happened to be in the booth at the time) and said, "My, it is surprising all the pretty colors you can wash out of coal, isn't it?" (Laughter.)

The remark rather took me off my guard and I said, "Well, if you call it washing, I suppose it is."

At that time there was a prevalent idea that dyestuffs and colors were mysterious compounds. They were new in this country, practically so at all events, and the man on the street didn't have any idea what benzol, toluol or naphthalene were, and probably didn't care very much. But as you all probably know, when coal tar is fractionally distilled, there are four main fractions obtained. The first fraction contains the light oils, benzol, toluol, and so on; the second, xylol; the third, naphthalene, and the last fraction, anthracene.

Chemistry of the Crudes

Benzol, toluol, naphthalene and anthracene are, of course, the basic crudes on which the entire foundation of the dyestuff manufacturing business is built.

When the chemistry of benzol was first investigated there were several theories established as to the constitution of benzol and its derivatives. I think possibly the most interesting and very likely the most satisfactory theory was that advanced by Kekulé who likened the benzene structure to a sphere, with six equal length bonds stuck in it. By "bond," of course, is meant the chemical term "valence." You have, undoubtedly, all heard of mono-valent, di-valent, tri-valent elements, and so on, even in inorganic chemistry. And the theory of carbon, the basic element of organic chemistry, is that each carbon atom has four valences or four bonds which admit of substitution. In other words, the simplest hydrocarbon, methane, is one atom of carbon, to each bond of which is attached one atom of hydrogen, giving the chemical formula CH_4. That, of course, is in the so-called "fatty series" of chemistry, to which dyestuffs do not belong.

The aromatic series then has as its base the hydrocarbon benzol, which is six atoms of carbon and six atoms of hydrogen, C_6H_6, and Kekulé advanced the theory that this molecule, as I said, could be likened to a sphere, and to each of these single carbon atoms is attached one bond which admits of substitution.

It is possible to build a very interesting mechanical explanation of that theory in this way. I haven't got a sphere, but you can imagine that this is one. By means of this Tinker toy I have improvised something that I think possibly may help in the explanation.

If you can imagine that this is a sphere instead of a disk, and imagine that these bonds are of equal length in relation to the center of specific gravity, then the theory is that this molecule in a very, very finely divided condition is whirling around in—I wouldn't say in space exactly (although I can use the term for purposes of illustration)—but at any rate, it is revolving at a tremendous rate of speed, as all atoms are supposed to do, and, of course, having a fixed specific gravity its sphere of activity is relatively limited.

If on the end of one of these bonds you add an atom other than hydrogen of higher molecular weight (in other words, hydrogen is the atomic weight 1, and if you substitute by chemical process another atom or molecule having a higher atomic weight or molecular weight) the center of gravity of that sphere is, of course, changed and by virtue of the change in the center of gravity, this thing (which hypothetically has been revolving, we will say, in a circle) won't revolve any longer in a circle but will start, in astronomical terms, to operate over an increased orbit.

By doing that, obviously, the activity of that molecule or atom is increased because it brings a larger range of activity and consequently admits of greater chemical possibilities in substitution.

Take another of these atoms or molecules which I show here by different colors (this is blue and this one red)—if this is a different weight from that, the center of gravity is going to be changed in still another direction and, of course, the activity is going to be increased.

Chemical Substitution Defined

At this point, what is called "substitution," in chemical terms, of this atom would amount to a thing of this kind: (Illustrating) Here we have a blue disk on the top and three red disks. Then you see what the chemist calls a "symmetrical substitution." This one, the blue, is of different molecular value than the three discs, they being equal to each other. This is a fairly well saturated benzol ring, and if this (the blue) is a hydroxyl group, OH, and each of these (red) is a nitro group, NO_2, the activity of that atom is increased so tremendously that at the slightest provocation it will disintegrate. You can liken it almost to a flywheel, another mechanical illustration, which is going around at a tremendous speed; if the rim load is increased for any reason the flywheel will ultimately burst if it gets going too fast; the centrifugal force at the rim of the flywheel will prove too much for the hub which is the center of gravity and the thing will break. The same thing is true of chemical substitution. The more active you make an element the more liable it is to decompose, and in this instance (the one that I illustrated with the hydroxyl group here and the three nitro groups) is the well-known picric acid which, of course, is quite a high explosive.

You can substitute, then, different chemical radicals in the benzol, or toluol, or naphthalene rings. Naphthalene, by the way, can be represented by a thing of this kind: two benzol rings fastened together like that, $C_{10}H_8$. (Illustrating.) Each one of these is a carbon. Here are two carbons which are common to both, and the other four on each one give us the formula, $C_{10}H_8$, Naphthalene.

As the substitution goes on in these different crudes, the activity of the compounds is increased, and by chemical means it is possible to arrive at the intermediates from which dyestuffs are made.

If you will refer to these papers that I have passed around and take the one marked "Benzol," you will see that the first derivation shows three compounds: phenol, chlorobenzol, and nitrobenzol. Nitrobenzol, as you will see, is the mother compound for benzidine, which in turn is the base for a large number of more or less well-known dyestuffs. Phenol, on the other hand, is indirectly the

mother compound for dianisidine, which also is the starting point for a number of very well-known dyestuffs.

Manufacture of Benzol and Other Products

I wish to say just a few words as to how these various substitution products are made. During the war there were made in this country tremendous quantities of phenol for conversion into picric acid, and it was made from benzol. The first operation is to treat benzol with sulphuric acid at suitable conditions of temperature and convert into what is called benzol sulphonic acid. That process is a very common one in the manufacture of dyestuffs—the process of *sulphonation*.

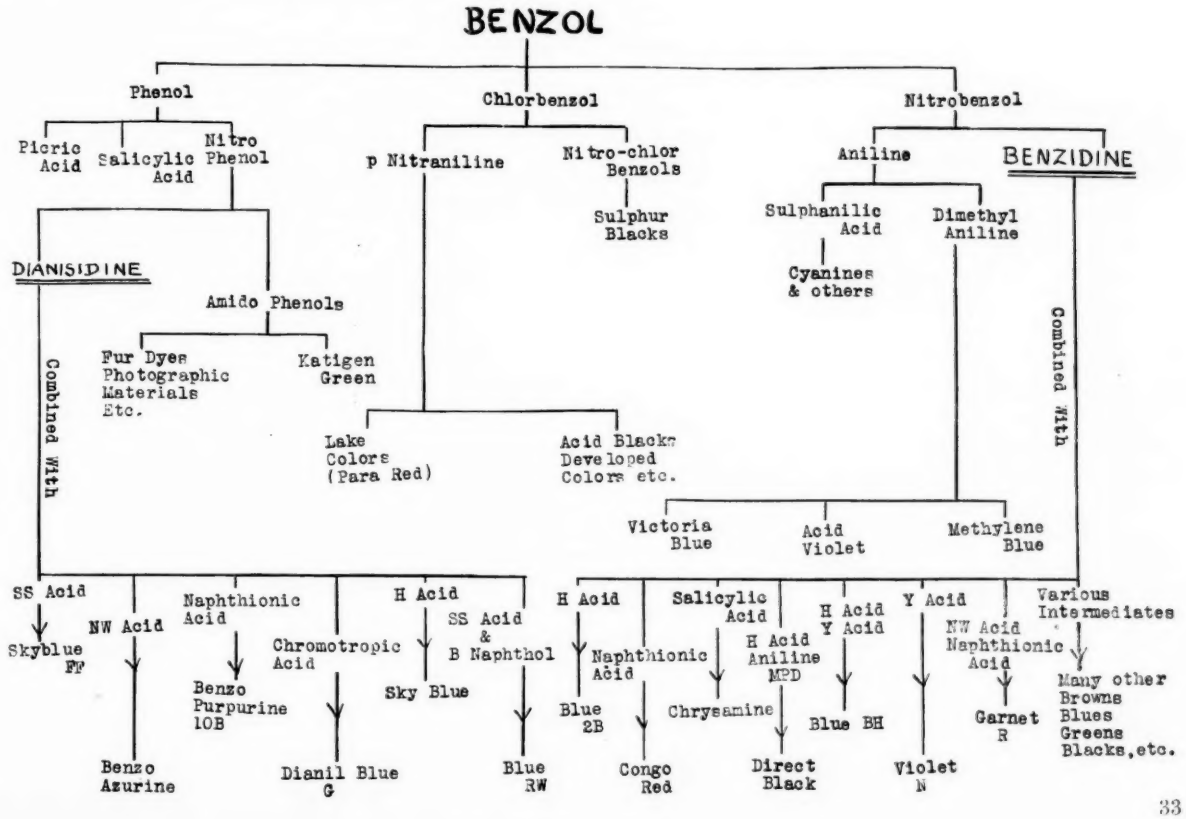
Then from this sulphonic acid of benzol, by a so-called fusion with caustic soda, phenol is obtained. This is another very important chemical reaction in the manufacture of dyestuffs—that of *fusion*.

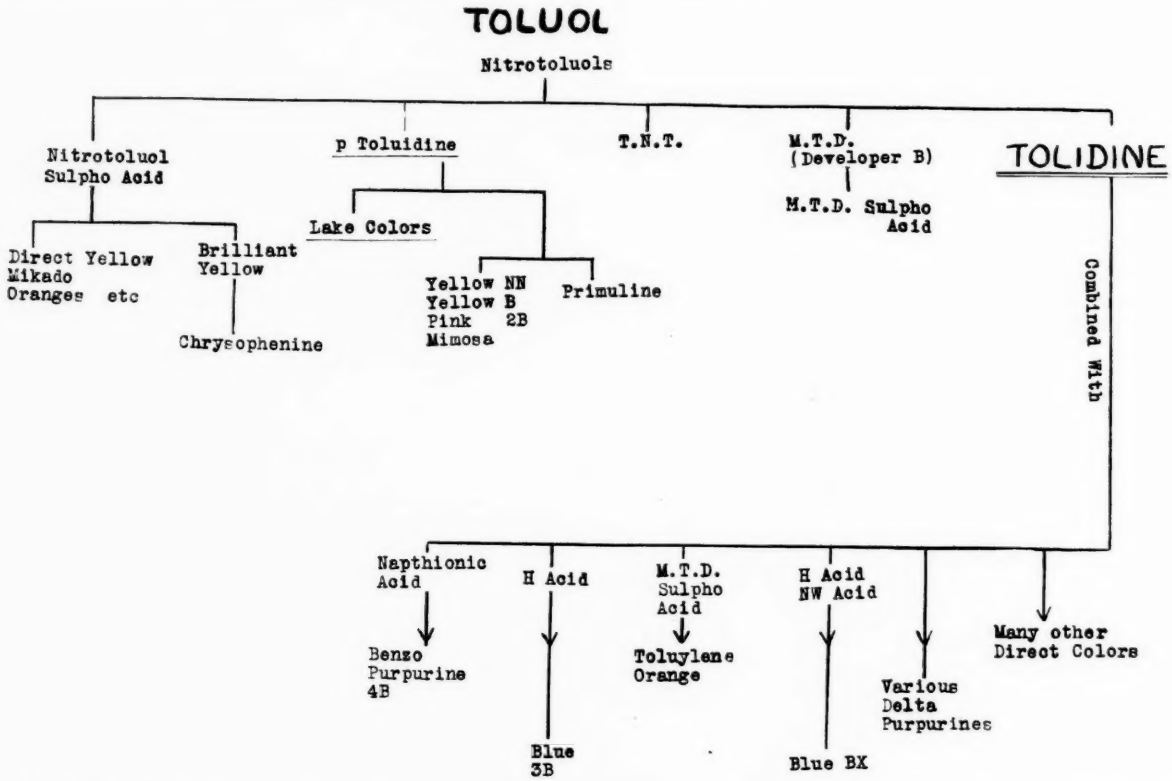
Nitrobenzol, on the other hand, is made by treating benzol with nitric acid, the process being called *nitration*. By a process of *reduction* of the nitro compounds, which contain the NO_2 group, substituted in the benzol ring for one of the hydrogen atoms, with what amounts to nascent hydrogen, usually generated by the action of hydrochloric acid on iron filings, are produced amido compounds. You will find on the left-hand side of the chart the derivative amido phenol from nitrophenol which is made, as I say, by the process of *reduction*.

By a suitable combination of the amido compounds, on the one side (such as aniline, benzidine, dianisidine, tolidine, and a host of others), with the sulphonic acids, or the naphthol-sulphonic acids—that is to say, the compounds containing the hydroxyl group caused by fusion and the sulphonic acid group caused by sulphonation—dyestuffs are formed.

As dyers you are all probably very familiar with the process of diazotizing and developing certain dyestuffs, such as Diamine Blue BH and Zambesi Black, Primuline, and quite a lot of others. When dyed they produce a certain definite shade which, by a treatment with nitrite and hydrochloric or sulphuric acid, can be converted into their diazo compounds; and then by a development of these diazo compounds with some suitable developer, such as Developer B, or beta-naphthol, or Developer Z (to mention a few of the more common ones), an entirely new dyestuff is produced on the fiber which in most cases is characterized by additional fastness.

In performing that operation in the dyehouse you are probably quite innocently doing exactly what the dyestuff manufacturing chemist is doing in the preparation of the colors which are in everyday use—direct





colors and acid colors. In other words, he takes an amino compound, which contains a free amido group, and treats it with nitrous acid (nitrite and sulphuric or hydrochloric acid), under suitable conditions, and obtains by that the diazo compounds of the amine. Then he adds, in tubs or suitable apparatus, this diazo compound to his sulphonic acid, or his naphthol, or his naphthol-sulphonic acid, and the act of running the two solutions together produces the dyestuff.

If you look down farther on the list you will find that benzidine combined with H acid produces the well-known dyestuff Blue 2B. Combined with naphthionic acid it produces Congo Red, and so on.

Of course, those are only a few of the dyestuffs which can be made from benzidine. On the other hand, from dianisidine and H acid comes the well-known Sky Blue. From dianisidine and SS acid comes the greener and brighter Sky Blue FF.

At the Charlotte meeting Dr. Wuth presented a paper at some length on the relation of the constitution of dyestuffs to their shade, and it is well known to dyestuff manufacturers that they can control the shade of the colors which they are making by a suitable choice of the intermediates they have available. For instance, if you took a mixture of Congo Red and the dyestuff which would be made from benzidine and NW acid (NW is Neville and Winther's, named after the two men who discovered it) and combined them in equal quantities, you would arrive approximately at the same shade which you get by dyeing ordinary Direct Garnet R.

The dyestuff manufacturer uses that knowledge in the preparation of these dyestuffs. In other words, by his knowledge of the chemical constitution of the colors and what the colors will produce, he can combine various intermediates to give the shades of colors which might be mixed in the dyehouse. By combining naphthionic acid and NW acid with benzidine he will arrive, as I say, approximately at the intermediate shade between Congo Red and the dyestuff which would accrue from benzidine and NW acid alone.

There is another peculiar thing about dyestuff manufacture which Dr. Wuth mentioned, and that is the fact that increase in molecular weight almost always (there are exceptions) results in denser shades. I don't necessarily mean shades inclining to the black, but I do mean shades which may in some instances be brighter or greener. A very striking example of that can be drawn in the dyestuffs which are made from naphthionic acid. The benzidine-naphthionic acid dyestuff is the well-known Congo Red. The tolidine-naphthionic acid dyestuff is Benzopurpurin 4B.

The dianisidine and naphthionic acid dyestuff is Benzopurpurin 10B. While there isn't so much difference in shade between Benzopurpurin 4B and Congo Red, there is a tremendous difference between the latter and Benzopurpurin 10B, and there you will find that the increase in molecular weight from the benzidine, to the tolidine, to the dianisidine (the other intermediates being the same) produces bluer shades and greater tinctorial value.

The same thing is true of the same three intermediates combined with H acid. It is even more striking, I think, in this case. The benzidine H acid dyestuff is Blue 2B. The tolidine H acid dyestuff is Blue 3B. The dianisidine H acid dyestuff is Sky Blue. There is a decided difference in shade. The higher the molecular weight (dianisidine being the highest) the greener the shade becomes.

So while the dyestuff manufacturer can't always forecast the shade that he is going to get (laughter)—those of us who have had any experience manufacturing dyestuffs will appreciate that remark—he has some idea before he starts out on a new problem about what intermediates he must have to arrive at a certain shade or a certain dyestuff which he wants to do a particular work.

Toluol—Its Products

Turning over to the toluol sheet, it is somewhat brief, but it tells a very interesting story of the various dyestuffs that can be obtained from toluol.

By nitration one gets nitro-toluols; and while there are three of them, I don't propose to enter into any technical discussion of these, because the theory is a little hard, of course, to understand. But you can take my word for it that there are three: ortho-, meta- and para-. Of these, the ortho- and para- are by far the most important.

On the left-hand side you will notice nitro-toluol sulphonic acid. That is obtained by treating para-nitrotoluol with sulphuric acid, and from that compound, by condensation with caustic soda, one arrives at Direct Yellow, Mikado Orange, and so on. By a further treatment into a compound known as diamino-stilbene disulphonic acid, the dyestuff Brilliant Yellow is obtained; and from Brilliant Yellow, Chrysophenine is made by ethylation.

From para-toluidine, which is also a derivative of nitrotoluol, the dyestuffs Yellow NN, Yellow B, Pink 2B, Mimosa are obtained on one side, and on the other the well-known Primuline.

Going further, we find that from toluol is made trinitrotoluene, the well-known explosive; M. T. D., otherwise known as Developer B, which is a well-known compound, and tolidine, of which I have previously spoken. Some of the more important dyestuffs made from tolidine are listed below, at the bottom of the chart.

Chemical Action of Stripping

I spoke a little while ago about the reaction of diazotizing and coupling, or diazotizing and developing, to use a textile term. Of course, as dyers you are all familiar with the act of stripping. It often becomes necessary in a dyehouse to strip off a shade that has been overdyed or that has to be redyed, and so on. To do that, one uses the compound hydrosulphite or some of its derivatives. There is a very definite relationship between stripping and discharge. Almost all direct dyestuffs, or azo dyestuffs, to use the technical term, will discharge to a greater or less extent. Some of them don't give a perfect white. Some of them perhaps might even be said not to discharge; but the majority of them do discharge white, and the reason for it is that the hydrosulphite splits the dyestuff into practically its original components.

Let us refer to this toy again. If you can imagine that this is a diazo compound, and this, we might say for purposes of argument, is benzidine, and this is H acid, and this has been treated with nitrite, converted into its diazo compound, and then coupled, the act of coupling those joins them together and creates the color, and there is a very definite bond between these two compounds. In the case of benzidine-H acid, of course, there are two bonds, because benzidine has two amido groups, and the resulting dye is a dis-azo dyestuff.

The very definite bond between these two is known as the chromophore; that is, it is the particular chemical constitution which creates the color. On treating that with hydrosulphite, either in solution or in discharge paste, when the hydrosulphite reaches the maximum of its activity that bond is split and the dyestuff ceases to exist. In other words, it is destroyed. The chromophore then being destroyed, the color is destroyed with it and, as I said before, the dyestuff reverts practically to its original components. It isn't exactly that, but it embraces a little too much theory, I think, to describe just exactly what does happen.

I have here some samples which you may examine afterward. Some of them are crudes and some are derivatives. But here is a sample of dianisidine. Here is a sample of H acid. Of course, you can see that they are practically colorless. They are gray powders. One is yellowish and the other is on a bluish cast. It doesn't seem possible that by a combination of those two you can get the beautiful Sky Blue FF.

When I was considering talking about this subject, I thought I might possibly show some chemical experiments, but I realized afterward that a dining-room table wasn't any place to do that, so I had to pass that thought up.

Condensation Products

Now I shall say just a word about the other side of this nitrotoluol group. I have been trying to explain that the theory of discharge or stripping depends largely on the fact that there are one or more azo groups or chromophores in the NN coupling in the dyestuff, and a destruction of that results in the destruction of the color.

In the case of Direct Yellow, Mikado Orange, Yellow NN, Yellow B and Primuline (to mention a few on this toluol sheet), those dyestuffs are not made by diazotizing and coupling. They are made by condensations with caustic soda, glycerine, dextrose and other reducing agents. The Primuline and the Yellow NN are made simultaneously in a fusion of para-toluidine with sulphur. In other words, they are not azo dyestuffs. That is the point I want to emphasize here, which it occurred to me might be of interest to dyers. That is the reason why those colors will not discharge: because they do not have the diazo link. They are essentially condensation products.

I don't know whether I have made that very clear or not, but you may ask questions afterward, if I haven't. I think perhaps that might be a little better, because I look at things probably a little differently than you do.

Talking about azo dyestuffs for a little while longer, I said that there were mono and diazo dyes. There are, in addition, tris and tetrakis azo. A mono azo dyestuff contains one diazo group; the diazo, two; the tris, three, and the tetrakis, four. There are dyestuffs that contain five, but they are very, very few. You can readily realize that the manufacture of some of these colors, particularly tetrakis azo, presents a good deal of difficulty in the plant.

Some time ago, when dyestuffs first were manufactured in this country to any extent, there was a great deal of comment about the fastness of the American-made dyestuffs. We all remember it. I think that the feeling has disappeared with the increase in lines that have been made and the increase in knowledge that has been attained by all people concerned, both manufacturers and users, because I do think the users of dyestuffs to-day know more about them than they ever did before, maybe because there is so much competition—I don't know. Anyway, I heard a story one time that rather amused me which will serve to illustrate the point: that the reason the German dyes were so much faster than the American-made dyes was because some mysterious person in Germany had an equally mysterious compound; he was the only one who knew anything about it; he went around to all the barrels in the warehouses before they were shipped and put this mysterious compound in, and by doing so made the dyestuffs fast. (Laughter.)

Of course, we all know that is absolutely foolish. We all know that American-made dyestuffs are just as fast as German-made dyestuffs, provided they are the same dyestuffs. No one, of course, would claim that an American-made Blue 2B is as fast to washing as German-made Indanthrene Blue GCD. But as long as the chemical constitution is the same, it doesn't make a particle of difference whether it is made in Japan, or Germany, or America, or Timbuctoo, as far as that is concerned, it is going to have the same fastness *It can't be otherwise.*

The Dyestuff Plant

Just a word about some of the apparatus used in making these dyestuffs. It might be interesting for you to know that the manufacture of H acid from naphthalene entails sulphonations which are carried on at a temperature of something like 160 deg. Cent., with oleum which contains a high percentage of free sulphuric acid. That is part of it. The fusion of H acid to introduce the hydroxyl group is carried on in a strong caustic soda solution, under high pressure, in a steel autoclave.

You can appreciate that such apparatus has to be very carefully designed and very carefully constructed, and the chemical reactions have to be extremely carefully controlled as to temperature and pressure, because when you consider that there is almost an innumerable quantity of sulphonic acids which can be made from naphthalene and that the success of their manufacture depends in some instances on a control of temperature of 5 degrees and a control of pressure of 5 to 10 pounds to the square inch (otherwise the yield is gone or you get an entirely different compound) you can readily understand that it calls for some pretty fine supervision.

The preparation of the amido compounds or the base intermediates, such as tolidine, benzidine, and dianisidine, also, of course, calls for just as careful manipulation. The actual dyestuffs themselves are relatively easy alongside the preparation of some of the intermediates.

If you went into a typical azo dyestuff plant, you would probably not be impressed by the apparatus which you would see. It consists mainly of a lot of tubs with, preferably, individual stirrers arranged on different levels,

with lead coils on the inside connected to a brine cooling system, and auxiliary dissolving tanks; filter presses fed by either air pressure or centrifugal pumps; drying rooms, and grinding machines, either of the Shutz-O'Neill type or the mushroom type, or any particular one that happens to be in favor with the individual manufacturer.

Manufacturing Problems

The idea, in producing an azo dyestuff, is to save as much time as possible in the operation, owing to the unstable character of most of the diazo compounds. Therefore, the dyestuff manufacturer tries to run his process as far as possible by gravity. In other words, the dissolving tanks and the diazo tanks will be on the top floor; the coupling tank on the second floor, in volume about equal to three times that of the combined volume of the diazo and dissolving tanks; and if he uses a salting out tank that is on the floor beneath, and as I said, is fed into filter presses usually on that floor, too.

The diazotization of most amines is conducted at a temperature between zero and 5 deg. Cent. The amine is first dissolved in hydrochloric acid to form the hydrochloride, is cooled down by the brine, or with ice; the nitrite is then added, and the whole stirred for an hour or so, until the reaction is complete, and then is immediately dropped into the tub containing the compound with which it is to be coupled; usually stirred overnight; warmed up, if necessary, next morning, and common salt added to precipitate the dyestuff; and then filtered.

Of course, it sounds easy, until you get in to a dyestuff which won't filter or a dyestuff which happens to like to have a particular speed of agitation to get the right shade —or things of that kind.

I remember very distinctly when we first started making dyestuffs. I think we were making Sky Blue, but we couldn't get the shade in the plant. We could get it in the laboratory, but not in the plant. There is nothing peculiar about that, of course, from the dyer's standpoint. But we could take the very intermediates from the plant and couple them in the laboratory and they would be all right. When we made the dye in the plant, it would be red and dull. We found this was the solution of it (it took a long time, but I can tell you the solution to illustrate how sensitive some of the colors are) we had dissolved the H acid the night before, allowing it to stir overnight, to insure complete solution. The liquid dashing around in the tub generated sufficient heat by friction to cause a slight decomposition of the H acid with the alkali that was in there, and that was the trouble.

It sounds easy, when you know the solution, but that would be about the last thing that anyone would look for, and it is just an instance of the troubles that the dyestuff manufacturer has.

After the dyestuff has been salted out and filtered and dried and ground, it is sent to the dyestuff house for standardization to commercial strengths, and then sent out to the trade—and that is the whole story. I feel that it is a very superficial description. As I said before, it is a subject which takes years of study. It is a fascinating subject because you never know when you have finished learning. The theory gets more involved the deeper you get into it, but I think that people who are using dyestuffs and people who are trying to sell them would be better in the application of their particular work if they did know a little more about the manufacture of some of them, the theory underlying the manufacture of them, and some of the troubles which the manufacturer has to contend with.

Thank you. (Applause.)

Discussion

Chairman Grandage—I am going to ask Mr. Knowland to read a letter which we have received from a member who lives too far away from here to attend these meetings regularly. This gentleman is seeking enlightenment on a problem that he has in connection with his work. After Mr. Knowland reads this letter, we would appreciate it if you would give this gentleman the benefit of any information you may have along this line.

. . . Secretary Knowland read a letter from Geo. L. Knoll, of Shamokin, Pa., as follows:

> I am writing you to see if I can get a little information in the printing of tin-weighted goods.
>
> We have been printing weighted goods with very good results, but now the question comes up: Is it possible to get a white polka dot (discharge) on dark shades of the 25 per cent weighting?
>
> I have worked very hard on this question for months, but to me it seems an impossibility. Of course, on light shades where a large percentage of hydrosulphite is not necessary I can get a very good white. But on dark shades where a larger amount of hydrosulphite is necessary to cut ground shade it seems to me to be impossible to get anything but a beautiful tan caused by the chemical action of hydrosulphite and tin.
>
> If this question is possible, what can I use to get results? Kindly have this question discussed at your next meeting where I can read same in my monthly magazine.

Chairman Grandage—If there is anyone here who is not working in active competition with this gentleman, would he mind helping him out? (Laughter.)

Secretary Knowland—Might I say I don't think the gentleman is right in what he says with regard to the

action of hydrosulphite on tin? I have made prints on heavily weighted tin, with very heavy hydrosulphite solutions, and didn't get tan; I got white. So the trouble he has is not tin. I think Mr. Scott had better answer that question.

Mr. Scott—I think before that question can be considered, he should name the dyestuffs he is using as a ground color.

Mr. Skelnick—Instead of using straight hydrosulphite, use hydrosulphite mixed with zinc, and also, don't wash the goods.

Secretary Knowland—That is done to a certain extent, but on long standing it comes back brown again.

Mr. Skelnick—It wouldn't, if you used just sufficient albumin to fix your zinc white.

Secretary Knowland—I don't think you are right there. I know of two silk mills where they are dyeing Navy Blues with sky blue, we will say F. F. Crescent, over heavily weighted tin, and it gives them a very fine sky blue that has a good shade; they are discharging as you suggest with hydrosulphite and sufficient zinc oxide to leave them white. After six months' standing on the shelf, they come back brown. There is a reason for it.

Chairman Grandage—Are there any more comments in regard to this question?

P. J. Wood—Mr. Chairman, I think it might be better for this gentleman to drop the idea of discharge work in this instance. He could probably obtain the same result by printing the pure dye silk with such colors as Indigosol and then doing the weighting afterwards.

Secretary Knowland—What is the comparative cost there?

Mr. Scott—The comparative cost is about equal. (Laughter.)

Secretary Knowland—Have you any idea of the comparative cost of the two processes, Mr. Wood?

Mr. Wood—I don't think it costs very much more, probably twice as much. (Laughter.)

Chairman Grandage—Are there any further comments?

. . . There were no further questions. Several announcements were made with reference to future meetings, following which a report was presented on the annual meeting of the Association at Charlotte. . . .

Chairman Grandage—If there are no other matters to come up at this time, I will call for a motion for a vote of thanks to Mr. Stott, our speaker of the evening.

. . . A motion was regularly made, seconded and unanimously carried to extend a rising vote of thanks to Mr. Stott. . . . (Applause.)

. . . The meeting adjourned at nine-thirty o'clock.

NOVEMBER MEETING OF PHILADELPHIA SECTION

The regular November meeting of the Philadelphia Section of the American Association of Textile Chemists and Colorists was held in Philadelphia on Friday evening, November 19, 1926.

The usual informal dinner at the City Club of Philadelphia preceded the meeting with seven members present.

The meeting proper was called to order by the secretary who officiated in the absence of the chairman, at 8.15 p. m., in the Auditorium of the Philadelphia Textile School.

C. E. Mullin was appointed as secretary *pro tem.* The minutes of the October meeting were read and approved.

The report of the Nominating Committee was read, the following members being nominated: For chairman, Ralph A. MacIntyre; secretary, Percival Theel; treasurer, Paul A. Endriss. Four members of the Sectional Committee: Lawrence A. Stead, Dr. Chas. S. Hollander, Chas. E. Mullin, Elmer C. Bertolet.

Additional nominations were then asked for. There being none, motion was duly made and passed that the nominations be closed. There being no opposition, motion was seconded and passed that the secretary cast the ballot. The ballot being cast the above-named nominees were declared elected for the year 1927.

There being no further business the meeting was turned over to the chairman of the Program Committee, Elmer C. Bertolet, who then introduced the speaker of the evening, C. W. Kuhl, of the Carbic Color & Chemical Company, who read a paper on "The Practical Application of the Indigosols." This paper was well illustrated by a number of dyed samples. Following a general discussion of the paper a motion was made and passed tendering the speaker a rising vote of thanks, and the meeting adjourned at 9.30 p. m.

There were about sixty present.

P. THEEL, *Secretary.*

The Practical Application of the Indigosols

By C. W. KUHL

Carbic Color & Chemical Company

Since the introduction of Indigosol O in the United States in 1923 there have been added ten new Indigosols:

Indigosol O4B from Indigo MLB4B or Ciba Blue 2B.

Indigosol Yellow HCG from Helindon Yellow CG.

Indigosol OR from Indigo MLBR.

Indigosol Violet AZB from Alizarine Indigo Violet B

Indigosol Pink HR Extra from Helindon Rose R or Hydron Pink FF.

Indigosol Orange HR from Helindon Orange R.

Indigosol Black TB from Thio Indigo Black B or Helindon Printing Black RD.

Indigosol Red HR from Helindon Red R.

Indigosol Scarlet HB from Helindon Fast Scarlet B.
Indigosol AZG from Alizarine Indigo G.

With the increase in the number of Indigosols, there have been suggested and developed a number of processes for their application, and as the application of these colors differs from any other class of dyestuffs, a summary of the new methods may be of interest.

On wool only Indigosol O, OR and Yellow HCG were supposed to be suitable, but it has been found that by the addition of sulphocyanide of ammonia to the dye bath, all the Indigosols can be dyed, and perfectly satisfactory results obtained.

Indigosols on Wool and Silk

The method in general comprises dyeing in a bath containing sulphocyanide of ammonia, acetic or formic acid, or both, and a final boil with the addition of some sulphuric acid not only to exhaust the bath, but also to insure penetration and solidness. Then the wool is washed, and oxidized for one-half to one hour in a fresh bath with sulphuric acid and chrome; at a low temperature of 68 to 85 deg. Fahr. in the case of Indigosol O and OR, or a higher temperature, 140 deg. Fahr., for the rest. The shades are solid, level and thoroughly penetrated; all have excellent fastness to rubbing except Indigosol O and OR, which in the case of darker shades should be thoroughly scoured or cleaned with fuller's earth. The fastness to fulling, steaming, etc., is excellent; the fastness to light varies, though Indigosol O is faster than any other dyestuff giving similar shades and the others are not far behind.

So far only Indigosol O has been used to any extent on wool, and chiefly for dyeing raw stock for uniform cloth. Here is some dyed raw stock, and a piece of the finished cloth, made by a mill who had no Indigo vat equipment, and who figured the Indigosol O, even at its higher price, would be cheaper to use than to purchase equipment which would only be used occasionally.

The raw stock was mordanted with chrome and tartar, dyed with 8 per cent Alizarine Blue WR Paste and 1½ per cent Alizarine Red IWS, then topped in a fresh bath with 8 per cent Indigosol O, and oxidized in the usual manner.

On silk Indigosol O and OR did not give good results, but the others could be dyed similar to wool in an acid bath, but at a temperature of 160 to 175 deg. Fahr, and oxidized with chrome and sulphuric acid. This method gave fairly good results on yarn, but on piece goods the results were not good; the dyeing showed a tendency to oxidize in the dye bath, causing streaks, and the penetration was not good. After a long series of experiments a method was worked out that is in practical use, and here are a number of swatches from practical dyeings with the Indigosols.

The pieces are entered lukewarm in the dye bath containing the color and sulphocyanide of ammonia, raised at 160 deg. Cent., and kept at this temperature for three-quarters to one hour, then a small amount of acetic, formic or sulphuric acid is added, and the pieces run 15 to 30 minutes longer. They are then washed and oxidized in a bath of chrome and sulphuric acid for two to three minutes, washed and soaped at a boil. The results are perfect in every way, and the dyeings are absolutely fast to washing and rubbing. Any kind of silk fabric can be dyed, weighted or unweighted, or they can be weighted after dyeing. The process works equally well on yarn, and the shades are also fast to cross dyeing with acid or chrome colors.

Silk can also be printed, using a paste containing the Indigosol and phosphate of ammonia, steaming seven to ten minutes, and oxidizing in a bath of chrome and sulphuric acid for two to three minutes.

On silk and wool a modification of the silk method, but using larger quantities of acid, shows good results in the laboratory, but practical trials are not completed.

On cotton the Indigosols are gradually coming into use in the styles for which they are adapted, and I have here some paddings, with and without resists, that are being made on a large scale. The light blues have been padded with Indigosol O4B according to the steaming process, dried on cans, printed with the white and colored resists, steamed in the Mather & Platt, and soaped.

The dark blue has been padded with Indigosol OR, nitrate process, dried, printed with the white and colored resist, passed through the ager, developed in a sulphuric bath, washed and soaped.

The blues being the first of the Indigosols, and also the cheapest and the most important colors for this class of work, were the first to be adopted, but the other Indigosols are also coming into use.

Practical trials have shown that the Indigosols can be dyed on the jig by the nitrite method; Glauber salt is added to the dye bath between ends, and the color driven on the fiber.

After six or eight ends, the goods are passed through sulphuric acid for development. Here is a swatch of cotton voile done in this manner.

The same method, modified to suit the needs, is used for dyeing warps and skein yarn.

Indigosols on Yarn

On warps the Indigosols are particularly adapted for cross dye work; they are faster than the developed colors, and easier to dye than the vat colors, and perfect penetration is obtained.

Here are some spools from skeins dyed with Indigo-

sols in an open tub, drained and oxidized without drying after dyeing.

Here are also skeins showing Indigosols on viscose for embroidery work. They are being used regularly and give results superior to anything except Indanthrene dyeings.

Here are a set of tables showing how the various Indigosols exhaust when dyed on yarn; they show that for light shades a standing kettle would hardly pay, for the darker shades with some of the colors it would be advantageous to save the bath.

Indigosols are also very well adapted for yarn and block printing either by the nitrite or steaming method. The pastes are not alkaline as with vat colors, so the blankets remain intact; also they can be left lay an indefinite length of time before oxidizing.

For the acetyl cellulose silks the Indigosols have no affinity; however, here are some prints of Indigosols on Celanese and cotton material made according to the nitrite process. After printing, the goods are steamed for fifteen to twenty minutes, which fixes the Indigosol on the Celanese fiber, and after development both fibers are colored alike.

In conclusion, allow me to say that while the Indigosols are classed as fast colors, they are not as fast as most Indanthrenes to light or chlorine. We find Indigosol dyeings to be faster than dyeings of the vat colors from which the Indigosols are made, but this is due to the complete penetration of the fiber with the Indigosols, not to any chemical change.

FORTY-SECOND COUNCIL MEETING

The forty-second Council Meeting of the American Association of Textile Chemists and Colorists was held in the Charlotte Hotel, Charlotte, N. C., on Friday, December 3, 1926. The following members were in attendance: E. H. Killheffer, W. S. Williams, W. M. Scott, W. R. Moorhouse, G. A. Moran, R. F. Culver, L. S. Little, A. R. Thompson, Dyer S. Moss, R. W. Hook, H. W. Leitch, W. H. Cady, and W. E. Hadley.

A motion was carried that any Local Section can form a Membership Committee, which could consider the qualifications of all applicants for membership in their section before same are presented to the Council for action. This method of handling applications will give more information to the Council, and will, in some cases, eliminate those candidates who the Local Sections know are not eligible in accordance with the terms of the Constitution.

The Council voted to approve the division of the present Southern Section. That portion comprising Virginia, North Carolina and South Carolina is to be known as the Piedmont Section. The other section will comprise the area west of the Appalachian Mountains.

The Council approved the recommendation of the committee on the award of prizes for best papers during 1925, as follows:

Seventy-five-dollar prize to Dr. Strachan, Brown University, Providence, R. I.: "The Accurate Measurement of Hydrogen Ion Concentration as an Aid to the Textile Chemist."

Fifty-dollar prize to William D. Appel, Bureau of Standards, Washington, D. C.: "A New Lamp for Fading Tests."

Twenty-five-dollar prize to W. E. Hadley, Maplewood, N. J.: "Brief Resume of Trade Waste Disposal."

W. E. HADLEY, *Secretary.*

Applicants for Membership

Active Members

Levitt, Benjamin, chemist, Chas. W. Young & Co., Philadelphia, Pa. Sponsors: Chas. E. Mullin and E. C. Bertolet.

Davenport, H. G., International Color & Chemical Company, Providence, R. I. Sponsors: J. F. Branscomee Doyle and D. P. Knowland.

Potsdamer, Louis S., consulting chemical engineer, Industrial By-Products & Research Company, Philadelphia, Pa. Sponsor: R. M. Moore.

Junior Members

Buddy, Gridley, textile chemist, S. Slater & Sons, Inc., Webster, Mass. Sponsors: D. Ferguson and Oscar H. Forsdale.

Lannaghan, Thos. J., assistant chemist, Bellman Brook Bleachery, Fairview, N. J. Sponsors: E. R. Borho and H. B. Sturtevant.

Remick, Lawrence E., laboratory assistant, Lever Bros., Cambridge, Mass. Sponsors: L. A. Olney and C. L. Howarth.

Thomas, Ernest W., student, Bradford Durfee Textile School, Fall River, Mass. Sponsors: Jas. Worton and C. Nelson Alderman.

Changes of Address

Davigne, Paul, 103 Brook Avenue, Passaic, N. J.

Deane, R. J., in care Robinson, Riverside Drive, Tiverton, R. I.

Glidden, Harlan E., Swarthmore, Pa.

Homer, Maurice B., 16 Arlington Avenue, Hawthorne, N. J.

Kendall, Charles B., Crown Hotel, Providence, R. I.

Ordway, Charles B., care Charles H. Bacon Company, London, Tenn.

Pfromm, John, 222 South Sixth Street, Shamokin, Pa.

Who Infringes a Patent and How Can Infringement Litigations Be Avoided

Cases of Infringement—Fine Points of Patent Law —Restriction of Use by Patentee

By Leo T. Parker

CHEMICAL composition, process and mechanical patents are the important ones for your consideration. And while the technicalities of each require a different procedure in obtaining a patent, the rules which govern infringement are practically the same.

As a matter of fact the unfamiliarity of so many persons with the fact that a patent gives its owner the exclusive right to *make, sell* and *use* the invention, probably accounts for numerous litigations in which innocent users of patented articles have been held liable as infringers.

Moreover, the majority of people believe that any person or firm is privileged to make a patented device for his or its own use, provided the article is not offered for sale. But this is not true. Others believe that a firm which buys an infringing machine or product from a reliable source may not be prevented from using it. But infringement exists under these circumstances for which the user is liable.

The United States patent laws were formulated explicitly for the purpose of creating interest in individuals who are naturally endowed with the inventive genius so that they might be induced to exert their faculty toward perfecting new and improved things, in anticipation of earning profits, as a result of which the public is benefited by the new things developed. And that is why the courts give inventors the benefit of doubts in patent infringement litigations.

Cases of Infringement

Of course, a patent may be so weak and narrow that a slight modification of the invention will avoid infringement. This is particularly true where the invention is no more than an unimportant improvement of a well-known and long-used product. But if the patent is on a basic or new invention or improvement, the claims may be sufficiently broad to protect the inventor against any other person or firm making a product even remotely similar. Under these circumstances avoiding infringement is an extremely difficult and hazardous undertaking.

For instance, in a recently decided case it was disclosed that several persons living in different States each arranged to manufacture a separate part of an invention. These various parts were shipped to another individual, who lived in a different State, and assembled into an infringing article. The patentee became informed of the infringement and instituted legal procedings against the various parties for damages in consequence of the sale of the manufactured and assembled articles. And notwithstanding the obscurity under which they were manufactured and assembled, the court held that the various persons were liable as co-infringers for damages and the earned profits. Another peculiar side of the situation is that the purchaser and users were liable even though they bought in good faith and without knowledge of the conspiracy.

An example of how an innocent firm was held liable for the infringement of a patented device is supplied by the records of a recently decided litigation in which it was shown that the company supplied its employees with non-infringing machines which happened to be constructed in such a manner that the mechanics were able, by slightly changing the mechanism, to importantly improve the operation of the machines, and incidently convert them into infringements of a patent. The owner of the patent filed suit and the court held the company whose workmen made the changes liable for infringement, although it was proved that the firm issued orders prohibiting the men from tampering with the machine or changing them in any manner.

In another case which involved practically the same point of law, it was disclosed that a firm manufactured and sold a machine which did not infringe the patent in litigation. However, it was proved to the satisfaction of the court that the company's salesmen explained to various prospective purchasers how, by a simple change of the mechanism, the machine might be converted into an infringing machine, thereby considerably increasing its efficiency. The court held the manufacturer of the machines and also the users who made the simple changes liable for infringement.

Therefore, in cases of this kind it is quite obvious that the evidence considered by a court is not so much whether the thing which is manufactured and sold is an infringement, but the important point is whether the device or product is used and operated as an infringement and if so, who conspired to effect the result? Generally, all of the users, but only the manufacturers who are in the conspiracy to infringe are liable.

Fine Points of Patent Laws

It is important to know that no person or firm infringes a patent if one important step or element of the claims is eliminated. For instance, where a firm obtained a patent on a process of making soap, which consists of washing an ingredient with a preparation and then mixing in a usual manner, another person or firm may use exactly the same material and make the soap if the washing process is eliminated.

However, the majority of persons appear to believe that if a patented article is improved by them, the infringement is avoided. It is important to know that adding to or improving a patented article will not avoid infringement, but substracting from it will.

For example, where an unauthorized manufacturer

used a patented process for making a product, he did exactly what the claims of the patent specified and other things, too. But the court held he was liable as an infringer. However, if he eliminated some important part of the process he may have been relieved of liability.

It is immaterial whether a person is an infringer in good faith and innocently, or for bad purposes and intentionally. The infringement exists under both circumstances where the law is violated, although the penalties are not the same in both instances.

The law is in effect that a firm or person who deliberately and purposely infringes a patented invention may be liable for three times the actual damages caused the patentee, and three times the earned profits. Whereas, an unintentional or innocent infringer may be liable for only the actual earned profits, and the damages incurred by the patentee.

Another important thing to know is that the owner of a patent is not limited with respect to the classes of infringers against whom he may institute legal proceedings for infringement of his patent. In other words, a patentee is privileged to sue either the manufacturer, seller, or user, or if desirable he may sue all of them.

Sometimes there is no actual manufacturer against whom an infringement suit may be instituted. Under these peculiar circumstances the patentee is privileged to use his own good judgment relative to the surest and most practical method of preventing the violation of his rights.

Sometimes considerable difficulty is experienced in securing convincing evidence that a process or chemical patent is being infringed. For this reason many manufacturers prefer to keep the information secret. And sometimes this is the wise thing to do. For example, in a recent litigation it was disclosed that a manufacturer who owned a patented process was almost certain that a competitor was using the process, but he was unable to prove it because the finished product was exactly the same whether made by either of the methods. It is well known that as soon as a patent is issued, its contents become accessible to other competing manufacturers, and therefore the information is virtually public property.

Another common source of litigation is repair work by an engineer or mechanic on a patented machine. In view of the numerous cases decided in which this point was involved, it is thoroughly established that there is no infringement where a minor worn or broken part of the patented device is replaced. But, if a machine or other device is so completely worn out that it is necessary to practically rebuild it and replace the operative parts of the machine, such extensive repairs may not be legally made without the permission of the patentee.

Restriction of Use by Patentee

To show how the owner of a patent may restrict the use of an invention: a patented article had attached to it a plate on which was printed a notice that the purchaser was licensed only to use the article for a particular purpose. The purchaser believed that he was privileged to use it for such purposes as he might choose. However, in the later litigation the court held that where the owner of a patent sells a patented product he has a legal right to specify the uses to which it is put, and if the sale is made with a proper notification to the buyer that the article shall be used for only a single purpose, although it is capable of performing numerous other functions, the purchaser is liable for damages if he uses it for other than the specified purpose.

However, where a patented product is purchased without restrictions as to its uses, and it contains no notification plate, the purchaser is privileged to attach such other patented or unpatented accessories to it as he sees fit, and may use it to accomplish any legal purpose, as if it was not patented.

Litigation is undesirable. Moreover, it is costly because so much time is consumed and quite often great expenses are incurred. One of the easiest ways of avoiding litigation and controversy is to know something of the law and past court decisions.

Since a purchaser and user of a machine, or part of a machine or a license of a patented process is liable as an infringer, irrespective as to whether it is purchased and used in good faith and without knowledge of its being an infringement, it is good policy for the purchasers of patented things to be relieved of the possible expenses of litigation by including the following paragraph or clause in the contract of sale:

"It is agreed that the seller shall pay all royalties and license fees relating to the product specified in this contract, and that said seller shall defend all suits or claims for infringement of patent rights and shall maintain the purchaser harmless from loss on account thereof, except that the purchaser shall be responsible for all loss when the product of the seller is changed or transformed by the purchaser in such a manner that a non-infringing device supplied by the seller is converted into an infringing one However, it is further agreed that if the seller has or later obtains information that the intended uses for the device is an infringement of a patent, said seller shall be responsible for the loss occasioned the purchaser, and agrees to impart said information promptly to said purchaser."

Controversy often results when an employee obtains patent on an invention perfected on the time of the employer. The law relative to this situation is that the employer rightfully owns the patent, but there has been so much litigation from this source, that it is advisable for all employers and employees to enter into contractual relations so that their understanding may not be mistaken. However, an employer cannot obtain title to an invention perfected by an employee at his home, because the law is that a person has a legal right to attend to his own personal business, at times when he is off duty, without accounting to his employer.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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STALKING WASTE IN THE MILL

THE annual inventory in the mill uncovers many a sorry record of waste. Slipshod, inefficient methods that have crept into the work of every department during the past year are seen in their true relation to operating costs when stock is taken. One is then astounded at the amount of supplies purchased during the year by the dyehouse and other processing departments. The record shows that there has been waste not only in actual operation of the department, but also in the purchase of certain colors, chemicals and equipment that have failed to reveal their alleged value.

Some of these materials were bought "on chance" and later found unsuited for the purpose in mind at the time of purchase. Large stocks of one kind of chemical or another were taken in and carelessly stored "out of sight and out of mind" until they had so deteriorated in strength that to use them would have involved further expense in spoiled goods; and this condition probably was the result of errors in estimating the requirements of the department in the matter of supplies. Equipment, neglected, could not be kept running smoothly; broken machine parts were not replaced; antiquated machinery was "doctored up" with new-fangle attachments that were guaranteed to reduce operating costs. The fact that equipment patched up in this way consumes far more time in operation than a new machine was a slight detail overlooked; and lost time, like lost supplies, comes under the category of waste.

A report outlining some of the surprising economies brought about in various industries through the introduction of simplified practice has just been issued by the Department of Commerce. The term *simplification* may convey suggestions as distasteful to the average mind as those connected with that much-disparaged word, "efficiency," but it really means nothing more than the elimination of waste by common-sense methods of purchasing and plant operation.

Simplified practice may be established in the mill, in place of wasteful habits, in several different ways. Much waste can be caught by the purchasing agent before it gets into the plant, by strict supervision of all supply orders. Old material can often be reclaimed and utilized—provided that it is not out-of-date machinery. Hours of valuable time and priceless human energy can be conserved by employing modern labor-saving devices and equipment; regardless of the cost of such equipment, every machine that saves some operator's time and labor ultimately cuts down running expenses.

The simplified practice report covers some of these outstanding points by apt quotations from current trade paper articles. This, from the "Southwestern Purchasing Agent," for instance, contains a general principle that can be applied to buying practice in every mill:

> The purchasing agent is a direct factor in the elimination of waste . . . in his function of utilizing storage facilities and of supervising materials in use, as well as in the procuring of supplies and the choice of equipment. By encouraging simplification and standardization of incoming products, as well as finished goods in his own plant, the purchasing agent can avoid the necessity of carrying excess inventories and of having large amounts of capital tied up in seldom-used commodities.

If the dyeing superintendent or the chemist in the mill does not actually buy such supplies as dyestuffs and equipment, he can at least co-operate with the purchasing agent in following a plan like that suggested above.

The big brother of simplified practice is that famous by-word associated with Hoover and Ford—*standardization*. In every industry standardized materials are helping to stamp out waste and duplication, to save labor and cut large slices from the production bill. The Commerce Department's report cites many actual cases to prove that standardization pays, and while most of them concern mechanical operations, such as railroading and machinery manufacture, the same principle holds true to an equal extent in fields where the *human* factor is large, as in the processing of textiles.

But there has been opposition, of course, to this practice of standardizing materials and processes; in every business the reactionaries are stronger than the progressive element. An industry standardizes in one place and pursues glaringly wasteful methods in another. In the textile industry the fastness of dyes and of colored fabrics is being intensively studied by standardizing experts, and soon we shall be able to

classify fastness intelligently. But the style groups, for reasons best known to themselves, have vigorously opposed attempts to narrow the *variety* of fabrics produced. And, as Henry S. Fickert, of the Cotton Textile Institute, recently said, "We certainly produce an enormous variety. . . . Some of the differences between them are very slight . . . a great many of these could be done away with, just as the yarn dyers, by establishing a standardized color card, have much improved manufacturing conditions without dissatisfying trade."

The chemical industry in several of its most important and highly competitive branches is working toward uniformity of specifications for quality, strength, packing, etc., and eliminating duplication of effort, thereby effecting a great saving in capital. It is reported in unofficial quarters that the German Dye Trust, in its process of reorganization and consolidation, will reduce the number of its dyes, estimated to be between seven and eight thousand, to a figure between two and three thousand. This is apparently considered adequate to take care of all requirements of their world's business, and will obviously result in a great reduction of operating costs.

Simplified practice and standardization taken together form what one noted industrialist has termed "a business philosophy which has for its ultimate goal the elimination of industrial waste." It is, furthermore, a philosophy not theoretical but intensely practical. Simplified practice will increase the production of a small dyehouse or laboratory to the same extent that it will increase the efficiency of an entire mill. Standardized materials will save as much money in the operation of one department, comparatively speaking, as in the operation of a complete plant. Keep the waste figures down on the next inventory by standardizing supplies and checking equipment constantly.

JAPAN ACTING AGAINST FALSE DYE LABELS

Dye Industry Grows Under Subsidy Plan

The market for foreign dyes in Japan is almost nonexistent, representatives of foreign concerns reporting the worst business in years. With a definite improvement in the textile industries, which is not yet in sight, there should be a change for the better; but even when normal demand is restored, the large warehouse stocks of the German I. G. and its selling methods complicate the situation, according to a dispatch from Commercial Attache Herrin, Tokio.

Falsification of dye labels and packages has apparently become so common in Japan that the Department of Commerce and Industry has informed all manufacturers and merchants that they must market their goods under labels unmistakably descriptive of their origin, and dye producers must pack their colors in such a way as to prevent restoration to their original shape or appearance. Merchants are to be prosecuted if they sell Japanese dyes under foreign labels or sell, as foreign colors, Japanese dyes mixed with the former.

The Government's purpose in seeking to prevent falsification of labels is not alone to protect the consumer, who may be willing to pay a higher price for imported colors, but to establish the excellence of certain Japanese dyes in the minds of Japanese purchasers. The Government apparently considers that some, if not all, of the colors produced by the Japan Dyestuff Corporation under Government subsidy are equal to American or German dyes in quality, and wishes to combat the impression still prevalent among some consumers that all foreign dyes are necessarily superior to the home product.

Dye Company Subsidy Ends

Last year the period for the subsidy by the Government to the Japan Dyestuffs Manufacturing Company, Ltd., ended and the manufacturing company was not in a position to carry on its business without this outside support, but, as the Government will assist the company directly or indirectly, it was decided to continue the business.

After revision of the import tariff, the company's manufactures have risen in price by 20 to 50 per cent. In August, 1926, an agreement as to the sale of the manufactures was reached between the company and wholesale merchants, and the company is now working at its full capacity. It is said that for the six months ended September, 1926, better results were obtained than for the preceding six months.

Concerning the subsidy which the Japanese Government has agreed to pay to Japanese manufacturers of some twenty dyes which the Government has designated, it is understood that one of the chief dye concerns, the Nippon Senryo Kaisha, is now turning out seven of the twenty. In March the company produced Kinolin Yellow for the first time, and since then has received the following subsidy grants on the seven:

	Kilos Produced	Grant Yen
Kinolin Yellow	6,500	60,799
Saffranin T	3,300	33,600
Naphthol AS	4,000	56,133
Direct Black BH.....	5,000	18,942
Direct Violet	1,300	3,564
Chrome Black F	11,000	50,592
Rhodamine G	150	1,487

Of these, Kinolin Yellow is said to be most satisfactory and may be able to pay its own way after the next six months, at the end of which the grant will be

withdrawn. Naphthol AS, Direct Black BH, Direct Violet and Rhodamine G can be produced commercially in the following six months under half the amount granted at present.

The subsidy fund is 800,000 yen, and is to cover expenditures over a period of six years.

Full production of the dyes is now expected to be secured in three years instead of five, as was fixed when the fund was established. In the event that full production is found possible in three years, the surplus of the fund will be utilized in paying grants on five or six other kinds of dyes, to be designated by the Japanese Government.

THREE NEW ADDITIONS TO NATIONAL COLORS

Three new colors—National Superchrome Black T, National Sulphur Brown R and Alizarol Brown RH Conc.—have been developed and placed on the market by the National Aniline & Chemical Company, Inc.

The Superchrome Black T, a new product for dyeing wool as raw stock, yarn or piece goods, is said to possess excellent solubility, to dye level and to have good penetrating qualities. It is regarded as an important addition to this manufacturer's series of chrome colors.

National Sulphur Brown R is also classed as a dye of good solubility and good fastness to both washing and light, especially when aftertreated with copper. It is recommended for use as a self-color or for combinations for ginghams, shirtings, etc.

The Alizarol Brown RH Conc. is described as an important addition to National's series of Chrome Browns, producing a shade of dark reddish cast. Possessing excellent fastness to washing, milling, perspiration and hot pressing, according to the announcement, it also has good fastness to stoving, carbonizing and rubbing. It is recommended for loose wool, yarns and piece goods.

TWO NEW BLUES AND BROWN ON NEWPORT LIST

The dyestuff laboratories of the Newport Chemical Works, Inc., Passaic, N. J., have developed and placed on the market three new colors: Newport Fast Acid Blue SR, Newport Acid Anthraquinone Blue B and Newport Fast Chrome Brown EB. Leaflets describing the properties of these colors and showing their shades on swatches have been issued by the Newport Company.

Newport Fast Acid Blue SR is recommended for the dyeing of woolen piece goods, yarns, felt, shoddy, etc., in all types of machines. According to the description, it possesses very good general fastness, especially to light, perspiration and salt water. It is said to be of value for shading chrome navies and blacks, also for dyeing wool in union materials from a neutral bath.

The Acid Anthraquinone Blue B is said to be distinguished for its excellent fastness to light, pure brilliant shade and excellent level dyeing properties. It is extremely useful, according to the announcement, for dyeing light and medium blues and for combining with other level dyeing acid colors for the production of slates, greens, drabs, etc., on carpet yarns, plush, dress material, knitting yarns, hat felts, etc. It dyes pure silk well from acid baths.

Newport Fast Chrome Brown EB is recommended for dyeing light and medium shades as well as mode shades on wool in all stages of manufacture. It is said to be level dyeing, of good solubility and penetration and to be suitable for all types of dyeing machines, and is further distinguished by excellent general fastness properties.

SULFANTHRENE PINK AND PONTAMINE BROWN AMONG DU PONT COLORS

The Dyestuffs Department of E. I. du Pont de Nemours & Co. announces two new products, Sulfanthrene Pink BG Paste and Pontamine Diazo Brown R. The first is said to show the usual fastness of the Sulfanthrenes to water, perspiration, acids, alkalies, rubbing, heat, etc., and to be very resistant to repeated laundering. Its shade, according to the announcement, is unchanged by the customary chlorine bleach. The penetration, exhaust and evenness of Sulfanthrene Pink BG Paste are also said to be very good. As its solubility is described as good, it is recommended for all types of machines. On account of the low caustic concentration and temperature required for dyeing this color, it is said to be especially suited for fast pinks on pure silk and to be good also for rayon.

The Pontamine Diazo Brown R, an entirely new product developed by the Du Pont Research Laboratory, is a full bright brown that gives clear white discharge with Sulfoxite C. It is further described as possessing excellent fastness for a diazo color, particularly to light, and as having excellent solubility and level dyeing qualities that make it suitable for use on the jig as well as on the various types of yarn dyeing machines employed for diazo colors. On cotton it produces reddish shades of brown; silk can be dyed from an acid bath, the shades produced being yellower than those on cotton. It is developed with beta-naphthol.

The Imhoff-Berg Silk Dyeing Company, Paterson, N. J., has concluded negotiations for the purchase of the plant and property of the Barretts, Palmer & Heal Dyeing Establishment, Englewood, N. J., and proposes to operate its main plant at this location. The mill aggregates about 75,000 square feet of floor space, with site totaling about 7½ acres of land.

PHILADELPHIA TO HAVE LARGEST CLEANING AND DYEING PLANT

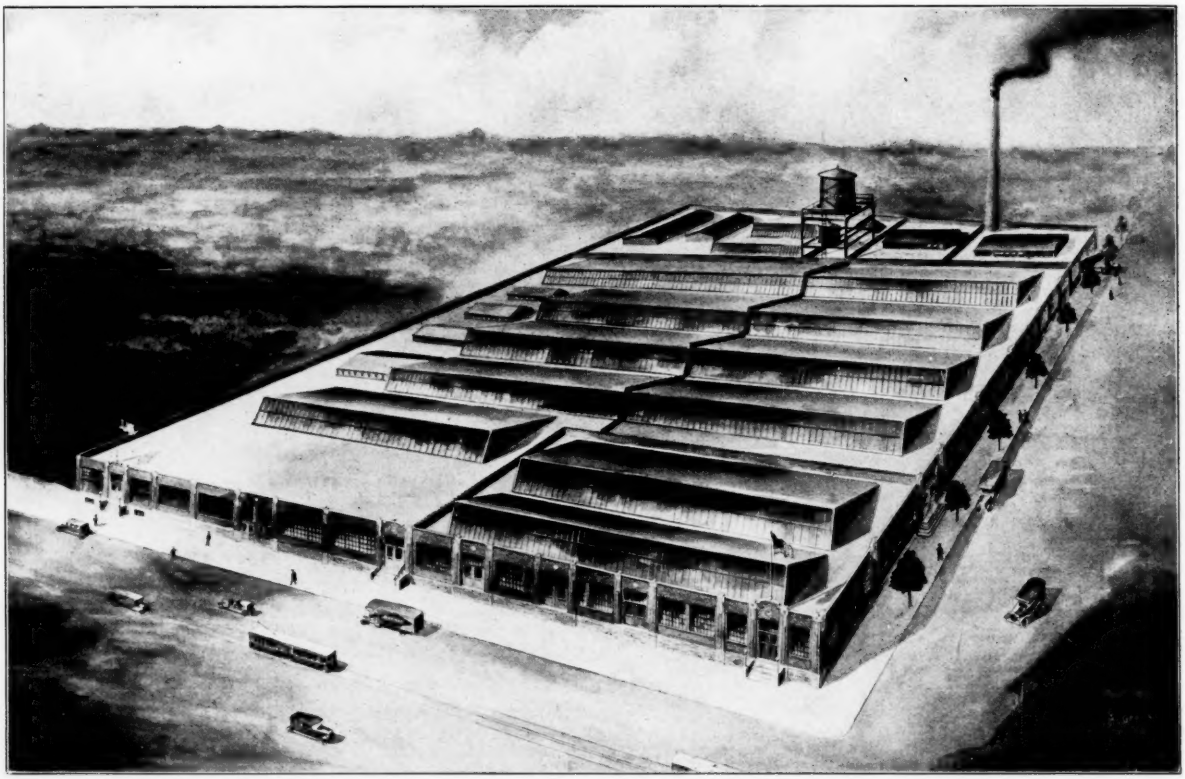
Under roof January 1, the new plant of Bornot, in Philadelphia, will be completed and in operation by May, 1927, the largest modern cleaning and dyeing plant in America.

Nearly three acres of ground are covered, the company having purchased two blocks close to the center of the city for the purpose, on Lehigh Avenue from Ridge Avenue to Thirty-fourth Street and from Thirty-fourth to Thirty-third Streets. Buildings will be fireproof throughout, and equipped with every precaution against fire, including automatic sprinkling systems. The most modern equipment will be used.

The main cleaning plant will be, with one exception, the largest single unit building in Philadelphia. It is of sawtooth roof construction, allowing direct north light at all times. The structure will be of cement, steel, brick and gypsum. The main cleaning plant will be 239 feet wide and 268 feet deep, having floor space of 64,500 square feet. It will be all on one floor, housing the executive offices, a retail branch, and rest, lunch and recreation rooms for employees. Cleaning will be divided into three sections, each direct-routed, and each in charge of an expert. One section will be devoted exclusively to men's wear, another to women's, while the third will clean curtains, furniture covers and other household goods. The main plant will face Lehigh Avenue, next to the famous Fairmount Park. In the next block will be the dyehouse, also in three sections, one for standard colors, one for fancy shades, and the third for carpets and draperies. A garage for the company's fifty delivery trucks will be in the rear of this building, and the large fireproof warehouse and modern storage plant will adjoin it.

Alfred T. Gerbron, well known among cleaners and dyers in this country and Canada, is president of the Bornot company. He is one of the very active members of the National Association of Dyers and Cleaners, treasurer of the Pennsylvania State Cleaners and Dyers Association for nine years, and president of the Philadelphia Cleaners and Dyers Association. Before the merger of the A. F. Bornot Bros. Company, the Herzog Company, John Dorfner and Barg's into the new Bornot organization, he was owner and manager of the Herzog plant, one of the most progressive and successful in Philadelphia.

He has been superintending the plans and erection of the new building for the past six months, with S. G. Matthews the engineer, and Albert MacGregor, the builder, and when the thousands of details were worked out and he had more time to devote to cleaning, he took over the active management of Bornot cleaning and dyeing.



Main Unit of the New Bornot Plant in Philadelphia, Overlooking Fairmount Park. When Completed in May It Will Be the Largest of Its Kind in the Country.

Technical Notes from Foreign Sources

Improvements in Mercerizing Piece Goods

The best results are obtained with mercerizing liquors at as low as possible a temperature and with a concentration of 45 deg. Be. The piece of fabric is allowed to remain in the liquor for a considerable period of time in order to attain complete saturation of the cotton. Tests were also made to determine whether or not this was true, and this investigation was accordingly concerned with the strength of the lye, its temperature and purity, the time of treatment and furthermore the twist of the yarn, its moisture content, the tension on the material while being treated, and whether or not the material had been boiled out.

As far as the temperature was concerned, it was found that a temperature over 25 deg. Cent. was best suited; a temperature lower than this was injurious. The longer the piece was in contact with the liquor, the greater the degree of contraction. Carbonates in the liquor have a bad effect on the shrinkage of the fibers, but this is not a serious matter, when the proportion of carbonates is not more than 8 per cent, figured as Na_2O.

The duration of treatment was at best thirty seconds. This can be reduced when just 95 per cent saturation is desired.

The shrinkage of the non-boiled-out cotton is very slight in the caustic solution. It is understood that the lye penetrates with difficulty only through waxes, sizes and the like which may be contained in the raw cotton, with the result that both the shrinkage and the luster of the mercerized cotton, when treated in the non-boiled-out condition, are less than in the boiled-out cotton. This refers to the cotton material which is entered into the lye without first being wetted down. When the unboiled-out cotton is wetted down first, it of course becomes difficult to maintain the concentration of the lye at its proper point. The best results are always obtained with the dry boiled-out cotton.

The stretch to which the fabric is put while being mercerized is also of importance, and generally the greater this tension on the fabric, both on the warp as well as on the filling, the better the luster of the mercerized fiber. The size of the stretching thus becomes of the highest importance in this process.

It is often found in mercerizing establishments that the strength of the caustic soda solution is too high, and this does not have a good effect either on the quality of the finished goods nor on the production, but invariably results in loss of materials. The temperature, which has been assigned considerable importance, is not so important as it looks and certain parts of the mercerizing installation, that is, the cooling devices, are really unnecessary.

The speed of the mercerizing machine should be between 80 and 90 meters per minute for light-weight fabrics. (Der Textilchemiker und Colorist, 1926, pages 154-155.)

Dyeing Leather

The leather, which has been properly prepared, is first mordanted with organo-metallic salts of the aromatic sulphonic acids which contain amino and hydroxyl groups in the molecule. Then it is dyed with suitable dyestuffs. The mordant is prepared by mixing together the hydroxides of chromium, iron, aluminum, copper and the like with acid potassium and sodium compounds and other compounds which have the power of dissolving these hydroxides. Then sodium carbonate, sodium acetate or other parts of organic acids are added. This mixture is then mixed with 1-amino-8-naphthol-3:6-disulphonic acid.

Thus, for example, 10 parts of 1-amino-8-naphthol-3:6-disulphonic acid are mixed with 2.26 parts of chromium hydroxide, 3 parts of anhydrous sodium carbonate, 4 parts of sodium acetate and 6 parts of potassium bisulphate. The leather is treated for approximately one hour with this mordant composition at a temperature of 40 to 60 deg. Cent. Then it is washed off and finally dyed. Chrome leather can be dyed with basic or substantive colors in accordance with this process and bark-tanned leather with substantive dyestuffs. (Swiss Patent No. 114,271.)

Determining Pure Wool Content of Raw Wool

The nitrogen content of the residue obtained by removing from raw wool all adhering nitrogeneous impurities is an accurate indication of the content of pure wool, which contains from 13 to 16 per cent nitrogen. For technical purposes a 30 gram sample taken from one kilogram of mechanically disintegrated raw wool is thoroughly washed with hot water, filtered, the residue dissolved in 20 c.c. of warm concentrated sulphuric acid in a tarred porcelain dish, and powdered gypsum added (with stirring) till the mixture weighs 100 grams. Subsequently the nitrogen content of 10 grams of the mixture, equivalent to 3 grams of raw wool, is determined by the Kjedahl method and the pure wool content calculated from the result.

Alternatively the washed and filtered wool is further purified by washing with trichloro ethylene or

carbon tetrachloride, then moistened with 3 per cent of sulphuric acid, dried (carbonized), washed with water, dried to constant weight at a temperature of 110 deg. Cent., and the residual pure wool is weighed. (Melliand's Textilberichte, 1926, volume 7, page 121.)

Red and White Discharges on Dark Indigo Bottom

Red discharges are obtained, without tendering the fabric, by printing cotton fabric prepared with beta-naphthol or beta-naphthol R (a mixture of 9 parts of beta-naphthol and 1 part of F acid) with a paste which contains 20 parts of lead chromate, 40 parts of starch-gum tragacanth thickening, 28 parts of diazotized para-nitraniline and 12 parts of water. The material is afterward passed through hydrochloric acid solution of 1.135 density which contains 30 grams of ferrous sulphate per liter. This treatment lasts from three to five seconds, and is effected at a temperature of 37 deg. Cent. Thereafter the fabric is steamed at a temperature of 35 deg. Cent. for thirty-five to forty seconds, when it is washed with water and soaped. The hydrochloric acid should not be stored in a lead-lined tank or trough, since the presence of lead acts unfavorably in the process of discharging the color. The printing paste requires rather deep engraving, twenty-two to twenty-four lines being used instead of the usual twenty-seven to twenty-eight on the printing roller. (Journal of the Society of Dyers and Colorists, 1926, pages 157-158.)

Printing with Basic Colors

The salts of the basic dyestuffs are converted into the free base or their leuco derivatives, and these products are mixed with the mordant, which may be the sulphurized derivatives of phenols or amines. This prevents the untimely formation of lakes in the printing pastes. For example: The solution of a basic dyestuff is mixed with a neutral thickening agent, the necessary proportion of sodium hydroxide is added, and then the mordant is added, such as katanol. A little hydrosulphite and soap may be advantageously added to the mixture whenever necessary. After printing, the cloth is dried, allowed to remain quiescent for twelve to twenty-four hours, and, when necessary, steamed. It is then passed through a solution of dichromate and acetic acid, washed and soaped. The process is suitable for printed white or naphtholated goods and for the production of colored reserves on an aniline black ground. (French Patent No. 603,121.)

Indigosol O in Dyeing and Printing

Details of many large-scale processes for printing and dyeing Indigo effects on fabrics by means of Indigosol O are described. Thus fabrics are dyed in a satisfactory manner by slop-padding with the aid of a solution which contains 80 grams of Indigosol O, 835 grams of water, 50 grams of an 8 per cent solution of gum tragacanth, 20 grams of a 10 per cent solution of beta-naphthol and 15 grams of sodium nitrite. The fabric is then dried on a hot flue or on drying cylinders, and the dried fabric passed for ten to thirty seconds through a developing bath maintained at a temperature of 20 deg. Cent. and containing 20 c.c. of sulphuric acid (66 deg. Be.) per liter. The goods are finally washed free from the acid. The proportions of the sodium nitrite in the bath varies in accordance with the proportions of the Indigosol O, and exact directions are given in the original article on the manner in which this variation takes place.

The presence of beta-naphthol in the liquor serves to increase the stability of the padding liquor. One disadvantage of using the sodium nitrite liquor lies in the fact that obnoxious nitrogen oxide fumes are liberated, but this can be prevented by the addition of an oxidizable acid to the liquor, such as formic acid. If salt or Glauber salt is added to the liquor, then the drying need not be carried out to so complete a degree.

The padding process is, however, not applied to very thick cotton and half-linen fabrics, for these are better dyed in the jig. The dyeing then takes place within a period of thirty minutes at a temperature of 20 to 25 deg. Cent. with a solution which contains 40 parts of Indigosol O, 20 parts of sodium nitrite, 180 parts of calcined sodium sulphate, 5 parts of Turkey Red oil and 1,000 parts of water. The liquor is uniformly squeezed out of the cloth and the latter is then directly entered into the acid-developing liquor. Thereafter it is passed through a neutralizing solution of dilute sodium carbonate liquor, washed and finally dried.

It is also possible to use the Indigosol O in a steaming process. This consists in padding the cloth with a solution that consists of 100 parts of Indigosol O, 705 parts of water, 50 parts of an 8 per cent solution of gum tragacanth, 15 parts of ammonium thiocyanate, 84 parts of a 10 per cent solution of sodium chlorate and 50 parts of a 1 per cent solution of ammonium vanadate, or 80 parts of Indigosol O, 10 parts of sodium chlorate, 10 parts of sodium ferrocyanide, 20 parts of ammonium thiocyanate or ammonium chloride, and 880 parts of a suitable thickening agent. The fabric is then dried on drying cylinders and steamed in a Mather-Platt apparatus or in a closed steaming apparatus for a period of two to fifteen minutes.

Indigo effects may also be obtained by the usual methods for producing aged Aniline Black, using a padding liquor which contains 100 grams of Indigosol O, 555 grams of water, 50 grams of glycerine, 25 grams of a 50 per cent solution of gum tragacanth, 10 grams of Turkey Red oil, 200 grams of ammonium chlorate solution of 15 deg. Be. concentration, 40 grams of ammonium oxalate and 40 grams of a 1 per cent solution of ammonium vanadate. It is possible to use padding liquors which contain Indigosol O and Katanol W or tannic acid or direct cotton colors or chrome colors. Fabrics which are printed with Indigosol O pastes may be overprinted with Aniline Black. (Melliand's Textilberichte, 1926, Vol. 7, pages 697-698.)

Corn and Potato Starches for Textile Finishing

Potato starch contains much less fat and protein than cornstarch and yields more viscous aqueous solutions. The viscosities of 5 per cent solutions of potato, corn and wheat starches are as 3.57:1.17:1.00, and a solution containing 150 grams of cornstarch and 2,850 grams of water has nearly the same viscosity as a similar solution which contains only 100 grams of potato starch to 2,900 grams of water.

Activin attacks potato starch more rapidly than cornstarch, and textile finishing pastes prepared by the action of activin on potato starch are about one-half as viscous as similar pastes which have been prepared from cornstarch. Biolase and Diastofor, Degomma and Novofermasol liquefy potato starch much less rapidly; equally and slightly less rapidly, respectively, than cornstarch. Potato starch has better binding properties when used in the weighting of textile materials. It is very difficult to prepare solutions of cornstarch free from gelatinized lumps, which are undesirable in finishing pastes. (Z. Spiritusindustrie, 1926, Vol. 49, pages 196-197.)

Wax and Fat Content of Different Cottons

An investigation was made of thirty different cottons, in which it was found that there is no characteristic difference in the content of fatty and waxy substances. It was also determined that conclusions may be reached on the nature of the cotton from differences that occur in these contents. It could not be established that the waxy cotton of the cotton had any effect on the spinning process. The properties of the waxes that are contained in Indian cotton enable the examiner to identify the cotton without any trouble.

The determination of the fatty content in sized goods was carried out by extracting the raw weave with organic solvents, whereby it was possible to establish the character and the quantity of the fatty materials in the size by extraction and comparison with extracts of unsized material. The fats which are most suitable for sizing purposes are tallow, Japan wax and castor oil. They are almost completely saponifiable and their presence is indicated by a high saponification index. In order to avoid errors it is also necessary to determine the fat content of starch and to take this into consideration in making this study, although this fat content is rather small. Tabulations are given in the original article which contain the analytical results. (Spulen und W., 1926, No. 17, page 16.)

Printing Tests with Nitrosophenol Dyestuffs

Certain compounds of the phenol class, such as beta-naphthol, resorcinol and the like, possess the power of forming nitroso bodies, which then give fast colors when used on metallic mordants. Various dye salts made by Kalle belong to this class, and these salts are printed on the fabric after or before it is slop-padded with nitrite of soda.

A new method for obtaining the compound of phenol and metallic mordant is directly the reverse, and has the purpose of utilizing these interesting dyes in addition to Para Red. Thus iron salts will give a deep dark green, nickel salts a pleasing red, chrome salts a dark tobacco brown. Suitable naphthols of the various naphthol preparations must be used in forming these dyestuffs.

Nitrous acid must be set free during the printing of these naphthol preparations by means of an acid in order to diazotize the naphthol. Acetic acid was found to be best suited for this purpose. The acid was employed in the form of a starch-gum tragacanth thickening containing acetic acid. The printing paste gave a slight foam of nitrous acid, but it is nevertheless just as stable as other printing pastes which contain nitrous acid, such as any diazotized dye. Thus it is possible to use the paste after it has remained unused for twenty-four hours without there being any marked difference in the color tone.

A composition which can be used for this purpose consists of 820 grams of starch-gum tragacanth thickening containing acetic acid, 100 grams of iron acetate 14 deg. Be., 30 grams of glycerine and 50 grams of sodium nitrite, making 1,000 grams in all. No color formation will take place when a neutral thickening medium is employed. This is easily understood, but less so is the fact that when the acid gum tragacanth-starch thickening is employed the color formation does not take place until the goods have been passed for approximately five minutes through an air-free Mather-Platt apparatus. What happens is that the color-forming reaction is retarded by the thickening agent which covers the naphtholated fabric.

It was thought possible to obtain a greater degree of stability in the color paste by using ammonium acetate in the place of free acetic acid. Experiments along these lines were unsuccessful, for the salt was not sufficiently decomposed during the short steaming process. It must be mentioned here that it was impossible to obtain good results not only with ammonium acetate but also with ammonium compounds of acids less volatile in steam. Tests with ammonium oxalate, ammonium tartrate, ammonium formate and ammoniu sulphate were not successful. The reason for this simply is that these salts do not decompose to a sufficient degree during the steaming process to liberate nitrous acid and permit it to effect its reaction.

The aforementioned formula is the most satisfactory for this purpose, but it is also possible to use the following in the place of the 100 grams of 14 deg. Be. iron acetate solution, viz.: 16 deg. Be. solution of nickel acetate, 15 deg. Be. solution of aluminum acetate, 20 deg. Be. solution of zinc acetate and 11 deg. Be. solution of chromium acetate (green). However, color tones of a practical character are obtained only with the nickel and chromium salts.

In order to obtain a deeper color effect the quantity of metallic salt is doubled, while the original concentration of naphthol preparation, 22 grams per liter, is left unchanged. Tests were also made with naphthol solutions containing 30 grams of the preparation per liter.

The best results were obtained in the latter case. It

was found that additional increases in the quantity of metallic salt, approximately 20 per cent, and in that of the naphthol preparation to approximately 50 per cent, not only gave no better results but the color tone was dulled.

The aforementioned nitroso dyestuffs have the property of combining with basic colors in limited proportions. Then the iron salt printed color may be brightened with the addition of Methyl Violet, for example; the nickel or chromium printed color by the addition of Rhodamine, etc. Brighter shades are obtained in this manner, the proportion of basic dyestuffs being 5 grams to the kilogram of the nitroso color. (Melliand's Textilberichte, 1926, pages 447-448.)

RECENT PATENTS

Device for Dyeing Suspended Hank Yarn

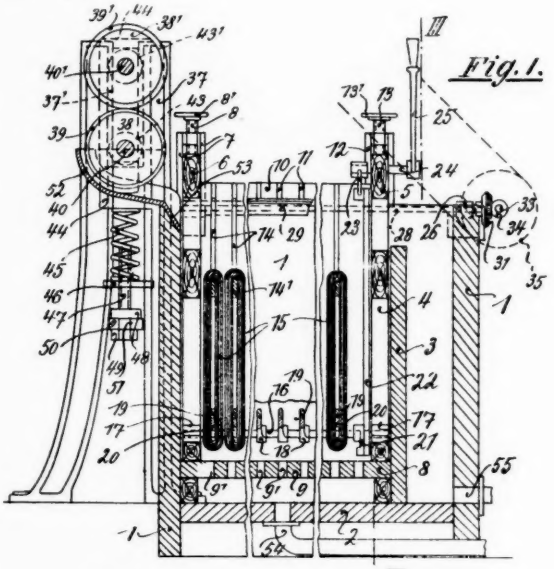
(1,598,205; August 31, 1926)

Rudolph Lichtner, of Mailand, Italy.

The dyeing of wool in the hank while the latter is kept suspended offers many advantages and is therefore generally practised. But it has been found impossible so far to obtain equally good results with respect to cotton for the reason that the suspended hanks could not be uniformly dyed at the points where they rested on their supports. The means hitherto employed to overcome this difficulty such as slow raising and quick, sudden lowering of the entire supporting frame or imparting an oscillating movement to it while keeping the liquor stationary or circulating or causing it to flow rapidly, etc., have not brought about the desired results, or to a very limited degree only, and required the construction of very complicated apparatus which did not permit the squeezing of the hanks immediately after dyeing as is necessary in case of sulphide and vat dyes to produce uniform coloring.

The present invention eliminates all these drawbacks and relates to a device for dyeing suspended hank yarns by means of a circulating vat dye liquor. The hanks are suspended from a frame capable of being inserted in the vat and provided with a device for moving the goods to be dyed during the dyeing process. To insure thorough and uniform dyeing of the hanks, particularly at the points of suspension, they are moved so that a slow upward movement is followed by a sudden downward movement. According to the invention the device is fitted with carrying poles for the yarn which are bent like a bow at their middle parts while their outer ends project from the vat, so that the poles in their entirety or in groups or singly can be slowly raised and quickly lowered by means of mechanically driven cams, etc., without removing the hanks from the liquor. It is furthermore possible to squeeze the yarn thoroughly and uniformly, while the vat dye is in a perfectly reduced condition, immediately after dyeing. Another feature of this invention consists in the fact that arrangements have been made to hang up the hanks in an easy and secure manner, so that the individual hanks are very close together without becoming entangled or causing entanglements of the threads of the individual hanks.

One form of the invention is illustrated by way of example in the accompanying drawings which show the device partly provided with hank yarn and in working position.



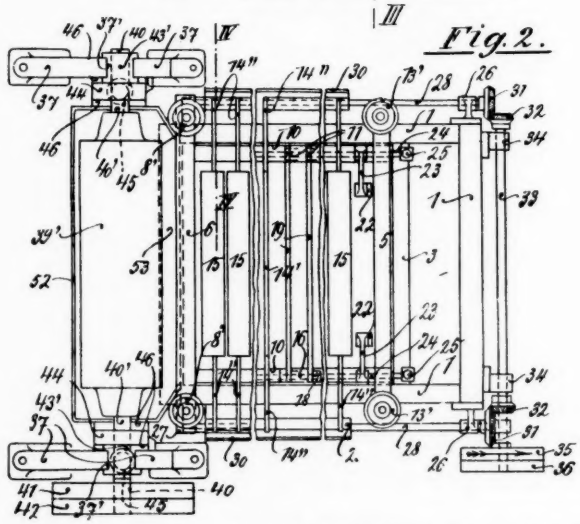


Fig. 1 is a vertical central longitudinal sectional view of the device, it being assumed that parts are broken away at the center of the device and that the upper central portion appears in side elevation.

Fig. 2 is the corresponding plan view.

Fig. 3 a transverse section on the broken line III-III in Fig. 1.

The device consists chiefly of the dye vat 1 with bottom 2 and overflow wall 3, the box or frame comprising the beams 4 and 10, and the squeezer which is directly attached to the vat. The squeezer consists of two rollers 38, 38′, supporting uprights 37, and a catch trough 52 having an outlet 53 to return the squeezed out liquor to the vat.

The beams 10 of the previously-mentioned frame are provided with notches 11 to receive the flat iron bars 14 which serve as carrying poles for the hank yarn to be suspended therefrom. The bars 14 are arranged on edge and bent edgewise and downwardly in such a way at their middle portion 14′ that the latter barely fits crosswise into the frame 4, 10 and that their outer ends 14″ can be inserted in the notches 11 of the beams 10 according to Figs. 1 and 4. The notches 11 are just deep enough to cause the ends 14″ of the bars 14 to project slightly over the upper edge of the vat 1 after the frame 4, 10 with the carrying poles or bars 14 has been inserted in the vat.

The frame rests on an intermediate bottom 9 provided with perforations 9′ and kept at a sufficient distance from the bottom 2 of the vat 1 by beams, so that the liquor passing through the supply pipe 54 in the center of the bottom 2 is distributed by the said perforations 9′ and thus reaches the goods to be dyed.

Attached to the two long sides of the frame 4, 10 are bearings 17 for the ends of horizontal rock shafts 16 carrying fixed collars 18 provided on the inner ends of rigid arms or levers 19 and 20, said collars being located at points which lie vertically underneath the notches 11 of the beams 10, so that the said parts 19 and 20 thus constitute holding arms for the lower loops of the hanks 15 suspended from the carrying poles or bars 14 on being swung laterally into the hanging yarn. The holding arms 19, 20 are arranged in two sets one on each side of the group of rows of hanks carried by the poles and extend at least to the center of the vat. On the rear ends of the shafts 16 are cranks 21, each of which, by means of a connecting rod 22, is connected with a corresponding upper crank 23 secured to a shaft 24 rotatably arranged in the upper cross beam 5 of the frame. At their rear ends the shafts 24 are fitted with hand levers 25. The cross beam 5 can be fastened at each end to the frame 4, 10 by means of the screw 13, the hand wheel 13′ and the guide 12.

In a corresponding manner an upper cross beam 6 is arranged on the other end of the frame in guides 7 and can be fixed by means of the screws 8 with hand wheels 8′ so as to be easily removable.

Rotably attached to the two long sides of the dye vat 1 are shafts 28 on which are rigidly mounted long bushings 29 and which rest in bearings 26, 27. Each bushing is provided along its entire length with a cam or wiper 30 which is of gradually-increasing height from its inner to its outer edge and terminates abruptly at the latter edge. Mounted on the rear ends of the shafts 28 are bevel wheels 31 which co-operate with bevel wheels 32, attached to a common shaft 33. Said shaft 33 is arranged in bearings 34 on the rear side of the vat 1, and provided on one end with fast and loose pulleys 35 and 36 for driving.

The squeezer is connected to the front end of the dye vat 1 in the usual manner and consists of the two previously-mentioned rollers 38, 38′ which are arranged parallel to the carrying bars or poles 14 and whole shafts 40, 40′ and bushings 43, 43′ rest in vertical slots 37′ formed in the uprights 37. The rollers 38′, 38 are provided with soft coverings 39′, 39 respectively, and the upper roller 38′ applies pressure by its own weight to the lower roller 38 which can be driven by means of the fast and loose pulleys 41 and 42.

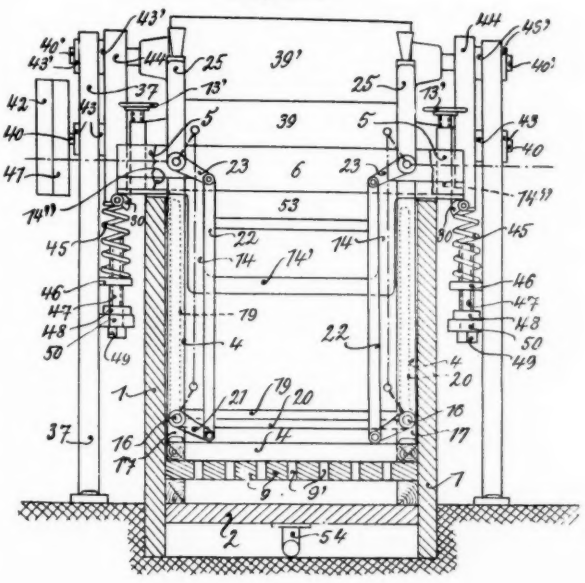
Should the weight of the upper roller be too great for the pressure desired in a given case, the bushings 43′ of said roller are, on the inside of the uprights 37, towards the rollers, mounted in inverted yokes 44 which straddle the bushings 43 of the roller 38 and its shaft 40 and which are firmly connected below with tension and compression springs 45. Each spring is further connected with a plate 46 adapted to slide along the inner surface of the adjacent upright 37 and guided by a screw 47 by means of a corresponding thread bore. This screw is inserted through a slit 51 in a bracket 50 on the upright 37 and is held in axial direction at the said bracket 50 by means of its head 49 and, on top, by a lock nut 48.

Operation of the Machine

The operation of the device is as follows:

The hanks 15 are placed on the poles 14, 14′, 14″ and then inserted together with them into the frame 4, 10, which is at that time outside the vat 1, after the

Fig. 3.



hand levers 25 have been swung into their lower or horizontal position indicated by dot-and-dash lines in Fig. 3, thereby actuating the crank system 23—22—21 and the shafts 16 to which the last-named parts are secured, so that the holding arms 19 and 20 are caused to occupy their vertical position represented in dotted lines. Then the poles, with the hanks evenly distributed along their depending central portions 14′, are inserted one by one into the frame 4, 10 by depositing their ends 14″ in the notches 11 of the longitudinal beams 10 of the frame. After all hanks have been put on the poles and all poles have been inserted into the frame, the hand levers 25 are swung back into vertical position while the lower holding arms 19 and 20 are passed through the hanks below the poles 14 until they reach the horizontal position shown in Figs. 1 and 3, in which position they do not rest on the lower loops of the hanks but are disposed a slight distance thereabove.

Circulation of the Liquor

After the above preparations have been made, the frame 4, 10, by means of cranes, pulley blocks, etc., is then inserted in the dye vat 1, as represented in Figs. 1 and 2, the vat having been previously filled with the dyeing liquor consisting, for example, of vat or sulphide dye solutions, etc., whereupon the liquor is circulated by a circulating pump, etc., by being withdrawn through the outlet 55 of the overflow chamber of the vat 1 and pumped back through the pipe 54 in the bottom 2 of the vat. By means of the perforations 9′ in the intermediate bottom 9 the liquor is distributed through the entire cross-sectional area of the vat which is filled with yarn and rises until it flows over the top of wall 3 into the overflow chamber, whence it exhausts through outlet 55. After a while the direction of rotation of the circulating pump is reversed, so that it sucks up the liquor through the branch 54 and returns it through the branch 55 over the overflow wall 3 and thus acts upon the hanks 15 from above. During this time the shafts 28 with their cams 30 rotate so that said cams 30, by means of their gradually rising surfaces, slowly lift the poles 14, 14′, 14″ and the hanks of yarn suspended therefrom until their highest points are reached, whereupon they abruptly drop the poles. While this is going on, the hanks almost float in the liquor and do not follow the downward movement with equal speed, but sink down gradually to their lowest position. The loops of the hanks resting on the central portions 14′ of the poles will be lifted off said portions and thoroughly penetrated by the liquor in this tensionless condition so that the yarn is thoroughly dyed at those points also.

The lower holding arms 19, 20 can be so arranged that, on lifting the hanks, by means of the poles up to the highest position, they hold the lower loops of the hanks during the last part of the lifting movement, so that the hanks acquire a certain tension and the liquor contained in them is partly squeezed out, whereupon the hanks lose their tension again while dropping and are saturated again with liquor.

After the yarn has thus been dyed thoroughly, the process is continued as follows: The beam 6 is removed from the frame 4, 10, the lower building arms 19, 20, are swung out of the hanks into their vertical position by means of the hand levers 25, the poles with the hanks remaining thereon are removed by hand, one by one, at the front of the vat 1, and the hanks passed between the rollers 38, 38′. The liquor still contained in the hanks is thus squeezed out according to the pressure applied by the upper roller 38′ and returns through the channel 52, 53 to the vat 1. In this manner premature oxidation of the vat dyes, etc., in the yarn while removing the latter from the liquor and squeezing it is effectively prevented.

The entire device may be mounted in a more or less enclosed room or in a glass box filled with a neutral gas. In this case the removal of the beam 6 and the lifting of the carrying poles 14 with the hank yarn 15 may be effected by machinery capable of being operated from the outside. The liquor is thus kept effective for the longest possible time as it is constantly and uniformly mixed during the dyeing process by the action of the circulating pump and the movement of the hanks, so that thorough and uniform dyeing of the whole amount of goods to be dyed is assured.

NEW SIZING FOR RAYON AND COTTON

A sizing compound recently developed by the Commonwealth Color & Chemical Company, Brooklyn, N. Y., and placed on the market under the name "Gelaglaze," it is claimed, produces horsehair effects with high luster on cotton and rayon. A leaflet issued by the manufacturer displays several attractive samples that contain effect threads sized with this product, which is said to be useful also for artificial fibers other than rayon.

CAPACITY OF CANADIAN SULPHURIC ACID PLANT TO BE DOUBLED

According to a press report, the sulphuric acid plant of the Mond Nickel Company, at Coniston, Ontario, is to be doubled in capacity to 120 tons daily. This plant utilizes the sulphur dioxide gases evolved in the smelting process.

Some sulphuric acid is exported from Coniston to the United States, but its principal markets are in Toronto and Montreal, where it is used in the manufacture of chemicals, fertilizers, steel, explosives, dyes, and in the tanning industry.

RECENT LITERATURE

Fabrics and How to Know Them. By Grace Goldena Denny. 152 pages. 55 illustrations. Revised edition. J. B. Lippincott Company. $1.50.

The J. B. Lippincott Company has just published a new edition of "Fabrics and How to Know Them" by Grace Goldena Denny, a work originally brought out in 1923.

This little handbook is of especial value to the textile field because it gives detailed definitions of the various types of fabric together with a number of remarkably clear illustrations of the different weaves. This edition has a new section which deals with the labeling of textiles, and Part II, which deals with chemical tests, has been enlarged and expanded to conform to the most recent developments in the textile world.

It is emphasized that the book covers only materials on the American market. Fabrics recognized as staple or standard have been chosen and, as far as possible, novelties eliminated. At the end of this little volume the reader will find a brief but valuable bibliography of works dealing with the important subject of fabric analysis from various points of view.

Van Nostrand's Chemical Annual. Edited by John C. Olsen, A.M., Ph.D., D.Sc. Sixth Issue, 1926. Revised and enlarged. 882 pages. Illustrated. $5.00.

Chemistry is not static; it is not standardized; it advances as rapidly as any other branch of science. But only a comparatively small part of the chemical knowledge gathered during last year's advance will be of practical value this year and next. The selection and compilation of only that data which are of permanent value for reference—such is the huge task accomplished for us by the editors of this Chemical Annual.

The contents of this very useful reference volume presents in convenient table and chart form many years of laboratory work. The book includes, in all, 233 tables and more than 150 pages of text, grouped under the following heads: General Tables, Calculation of Volumetric Analysis, Specific Gravity Tables, Alcohol Tables of the Bureau of Standards, Vapor Tension Tables, Equivalents of Weights and Measures, Thermochemistry, Stoichiometry.

A thorough survey of the literature of chemistry has been made for new information published since the last issue, and all tables for which new data have been found have been revised and corrected. All molecular weights have been recalculated in accordance with the atomic weights of 1925. A very considerable number of new tables have been added. They include tables on Isotopes, Hydrogen Ion Concentrations and Hydrogen Values, Specific Gravity and Solubilities, Isoelectric Points of Proteins and Pressure of Aqueous Vapor of Hydrated Salt Systems.

Very few of the older tables have been eliminated, as the tables included in previous issues were selected with great care and are standard and not often subject to replacement. The list of new books has been revised and replaces the old bibliography.

Tag Recorder Catalog. 104 pages. Illustrated. Tagliabue Manufacturing Company, Brooklyn, N. Y.

Temperature is one of the "little big things" in industry upon which depends the success of innumerable processes—many of them involving costly materials with which no slightest risk can be taken. But temperature is not a tangible thing; it varies by the hour and so must be accurately recorded if processing troubles are to be easily and quickly traced to their source. Thus the recording thermometer and pressure gauge keeps guard over this important detail of plant operation.

This new Tag catalog, like most of its predecessors, is attractively printed and bound, and contains something more than pictures of thermometers and gauges. It tells in a most interesting style of the uses of these instruments in such widely different processes as dyeing textiles and pasteurizing milk, and illustrates a variety of installations. The main sections are devoted to detailed descriptions, excellent illustrations and specifications of Tag mercury, vapor tension and gas-filled recording thermometers and similar instruments.

USEFUL INDEX OF DYE MANUFACTURERS COMPILED BY S. O. C. M. A.

An alphabetical index of 185 American manufacturers of dyestuffs and other synthetic organic chemicals has just been published by the Synthetic Organic Chemical Manufacturers' Association. The index lists each manufacturer's full name, address and products, the latter classified in each instance under headings, as Crudes, Intermediates, Dyes, etc. The Schultz and Colour Index Numbers of the dyes are given.

LIST OF COAL-TAR DYE STANDARDS

A supplemental list of standards of strength of coal-tar dyes has been announced by the Treasury Department.

This supplemental list adds sixteen dyes to the standards, names fifty-two for similitude to dyes already listed, and removes four from the prior list, owing to error or duplication.

The standards are used in assessing the specific duty of 7 cents per pound which is assessed in the proportion that the strength of the import bears to the strength of similar commercial imports prior to July 1, 1914.

The Fashion Textile Printing Company, Paterson, N. J., recently formed with a capital of 500 shares of stock, no par value, to operate a local plant, will be represented by Edward A. Smith, 52 Putnam Street, one of the incorporators. The other incorporators are Agnes B. Smith and John A. Kane.

Guy Yerxa has taken the position as second hand in the finishing department for the Norad Mills, North Adams, Mass. Mr. Yerxa comes from Oldtown, Maine.

The Erwin Mills, Erwin, N. C., have ordered from Borne-Scrymser Company sufficient oil spraying equipment to equip another one of their plants.

A new customs tariff for the Netherlands East Indies which is being drafted by a special tariff commission has been under consideration for some time, but the final report of the commission will not be rendered earlier than the middle of 1927, perhaps even later, according to Consul C. L. Hoover, Batavia.

Dr. Charles H. Herty, adviser to the Chemical Foundation, delivered an address January 7 at the Massachusetts Institute of Technology on "The Chemists' Formula for Industrial Success."

P. F. Johnson has resigned as salesman with the Arabol Manufacturing Company, and accepted a similar position with the National Gum & Mica Company.

W. E. Clifford, superintendent of the coal-tar division of the Kentucky Color & Chemical Company, Louisville, has been elected a vice-president of the company.

Edwin H. Marble, president of the Curtis & Marble Machine Company, Worcester, Mass., has been awarded a fellowship by the Textile Institute, Manchester, Eng. this being the second award to a member in this country, the previous recipient having been J. T. Broadbent, president and general manager of the Standard Textile Products Company, New York City. Mr. Broadbent is vice-chairman and Mr. Marble a member of the executive committee of the Textile Institute Club, recently organized by members in this country of the Textile Institute for the purpose of promoting textile research.

Frank Bernhard, overseer of dyeing for the Hockanum Company, Rockville, Conn., has resigned his position with that company.

J. E. Smenner has lately been made boss dyer of the Bradley Manufacturing Company, Columbus, Ga., being promoted from assistant dyer.

Roy N. Lotspeich was elected president of the Appalachian Mills Company, Knoxville, Tenn., at a meeting of the directors last week, succeeding J. T. Brownlee. Mr. Lotspeich was also re-elected treasurer. Two new vice-presidents were elected, R. R. Spliman and Ira A. Watson. T. L. Henry was re-elected secretary, and A. E. Warren was re-elected general superintendent of the plant. All directors were re-elected.

PRESIDENT OF PFALTZ & BAUER RETIRES

Henry Pfaltz, president for many years of Pfaltz & Bauer, Inc., New York City, has retired from business, disposing of his stock interest in the company to his partner, Frank M. Bauer, who will continue in the sole and active management of the business.

Messrs. Pfaltz and Bauer were associated for more than a quarter of a century and Mr. Pfaltz' retirement from the business is keenly felt by his business associates and those in the chemical trade with whom he has come in contact during his long and active business career.

Several employees who have been with the firm for many years have now been made officers of the corporation, as follows: President and treasurer, Frank M. Bauer; vice-president, Kurt Walwer; assistant treasurer, B. O. Hoffman; secretary, N. L. Fremed.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

DYE SALESMAN WANTED

Manufacturer of Acid, Direct, Sulphur and Oil Soluble Colors has this position open for a "live wire." Applicant must be well known and have a good following. Opportunity also for investment. Reply American Dyestuff Reporter, Box 372.

SUPERINTENDENT OF DYEING

Superintendent of dyeing; graduate chemical engineer well versed in plant management methods. Experienced dyer and finisher. Specialty: vat and insoluble azo colors on cotton, rayon and silk piece goods. Now employed. Seeks more exacting responsibilities with commensurate remuneration. Reply Box 373, American Dyestuff Reporter.